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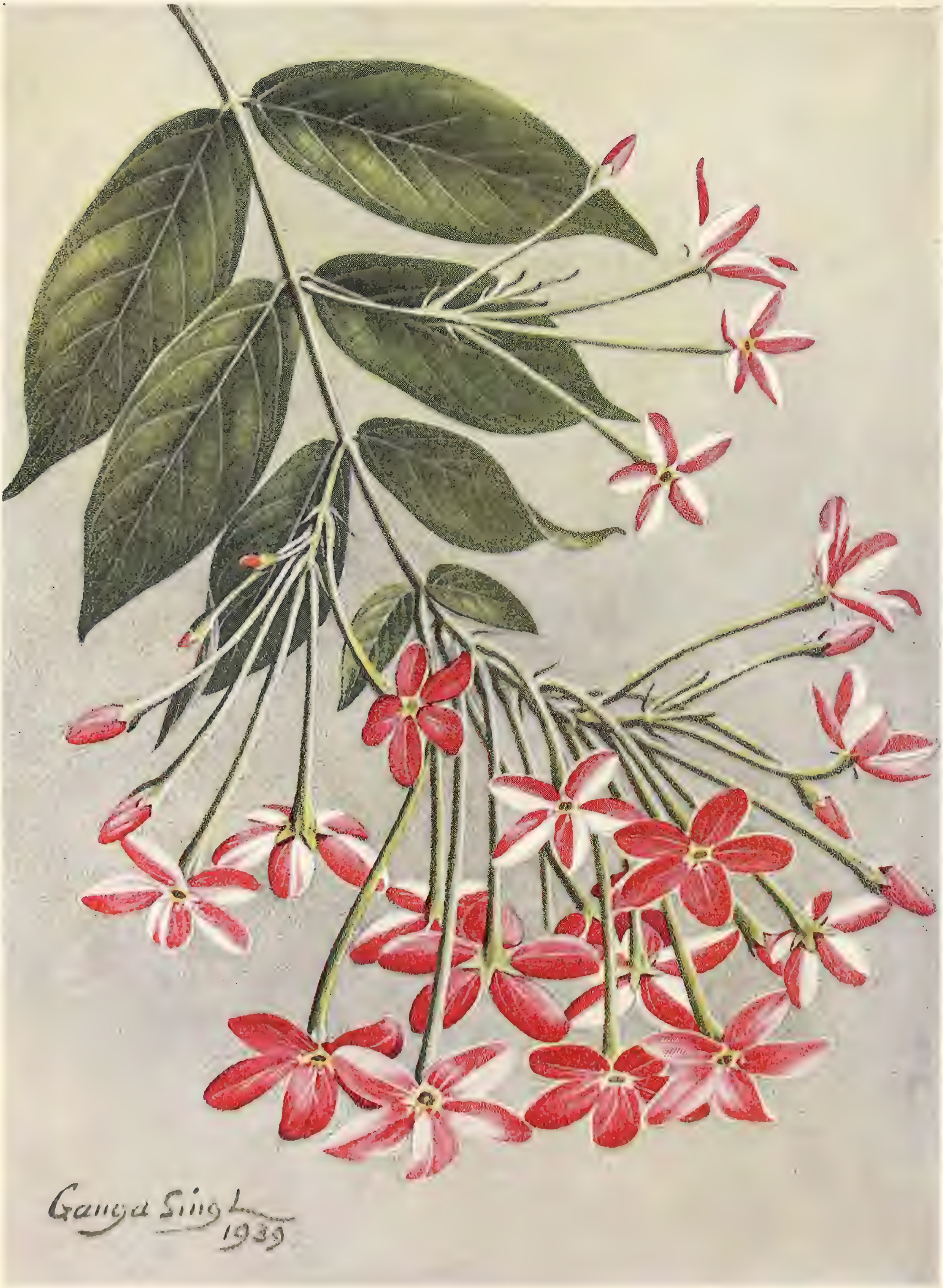
Ganga Singh
1939

The Rangoon Creeper.
QUISQUALIS INDICA Linn.
(Nat. Size.)

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SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

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PART XVIII

(*Continued from Vol.* xliv, *No.* 4 (1944), p. 505).

(*With 2 coloured and 2 black and white plates*).

Quisqualis Linn.

A genus of the family *Combretaceae*. The name *Quisqualis* means literally *who? what?* and was first given to the plant by Rumphius (George Eberhard Rumpf), the Dutch botanist, and expresses his astonishment at what he calls the curious behaviour of the species *Quisqualis indica* Linn.. which we are about to describe. According to Rumphius the young plant grows up into an erect shrub with scattered leaves and irregular branches. After six months it sends out a runner from the root which is much stouter than the original stem, and this runner then proceeds to climb up the neighbouring trees, not by twining round them but by means of the petioles which become transformed into stout spines after the fall of the leaves. The name of this climber remains as an exclamation of astonishment but the plant as regards its growth is uninterestingly normal.

Quisqualis indica Linn.

The Rangoon Creeper.

A very large woody creeper which is indigenous in Malaysia, south-eastern Asia and west tropical Africa. It is considered not to be indigenous in peninsular India, but it has become so popular as a cultivated plant that it is now one of the commonest creepers to be found in Indian gardens.

Description.—A very large scandent deciduous shrub with a cylindrical stem, green when young, covered with soft brown or golden hairs. Leaves opposite or nearly so, without stipules, oblong or elliptic in shape, slightly cordate at the base, tapering to a blunt or notched apex, 3 in. long; margins entire. The upper surface of the leaf is smooth and glabrous except for the nerves which are hairy: the under surface is softly hairy on the prominent main nerves and on the reticulation. The petioles are short, up to 1/3 in., softly hairy, and are often persistent after the fall of the leaf becoming transformed into stout curved spines which assist the plant to climb. The flowers are borne in axillary or terminal pendulous racemes. Each individual flower is seated on a short pedicel which emerges from the axil of a small leaf or bract on the main axis of the raceme. The flower itself consists of three parts which can be easily made out: a basal 5-angled ellipsoid portion, ¼ in. long; a tubular green section, 2¾ in. long, and five-coloured petals. The basal four-angled portion contains the ovary. A longitudinal section through the ovary will reveal that it consists of a single cell from the apex of which hang 2-4 ovules attached to long strap-shaped funicles. The inner surfaces of the funicles are papillose. The filiform style is as long as the calyx tube and ends in a sticky knob-shaped stigma. The calyx tube or hypanthium is slightly constricted above the ovary and is narrowly funnel-shaped, hairy on the outside, dividing at the top into five triangular teeth. The ten stamens are arranged in two rows. One row of five is attached to the tube just inside the mouth, and the stamens are alternate with the calyx lobes. The other row is seated about ¼ in. lower down on the tube and alternates with the stamens of the upper row. As the filaments are ¼ in. long, one row of stamens is exserted while the other five only just reach the mouth of the tube. The petals, which are softly hairy outside, are imbricate in the bud and are attached to the calyx tube just at the mouth and alternate to the lobes. The petals are obovate in shape, nearly ½ in. long, rounded at both ends, and are attached to the calyx by a mere point. The outer surface of the petals is slightly flushed with pink, the inner surface after the bud has opened is a pure white, which slowly turns pink and finally a rich red. The flowers are beautifully scented in the evening. As the inflorescence is racemose, that is, the flowers open in succession, there are to be found flowers of all ages on the plant, hence the effect of the numerous blossoms, some white, some pink, some red, is very striking. The fruit is narrowly elliptic, five-angled, about 1 in. long.

Economic uses.—The fruits have a great repute for their anthelmintic properties. The bitter liquid which results from pulping the unripe fruit in winter is often used for this purpose. The ripe fruits although they can be used as a vermifuge, are not so efficacious. The ripe nuts are pleasant to the taste and are eaten but only in strict moderation. In this connection the remarks in Curtis' Botanical Magazine (sub. tab. 2033) are interesting: 'It is observed that, though some persons, and among these are Rumphius himself, could eat these kernels with pleasure and impunity, in others they soon produced nausea, followed by a troublesome hickuping'.

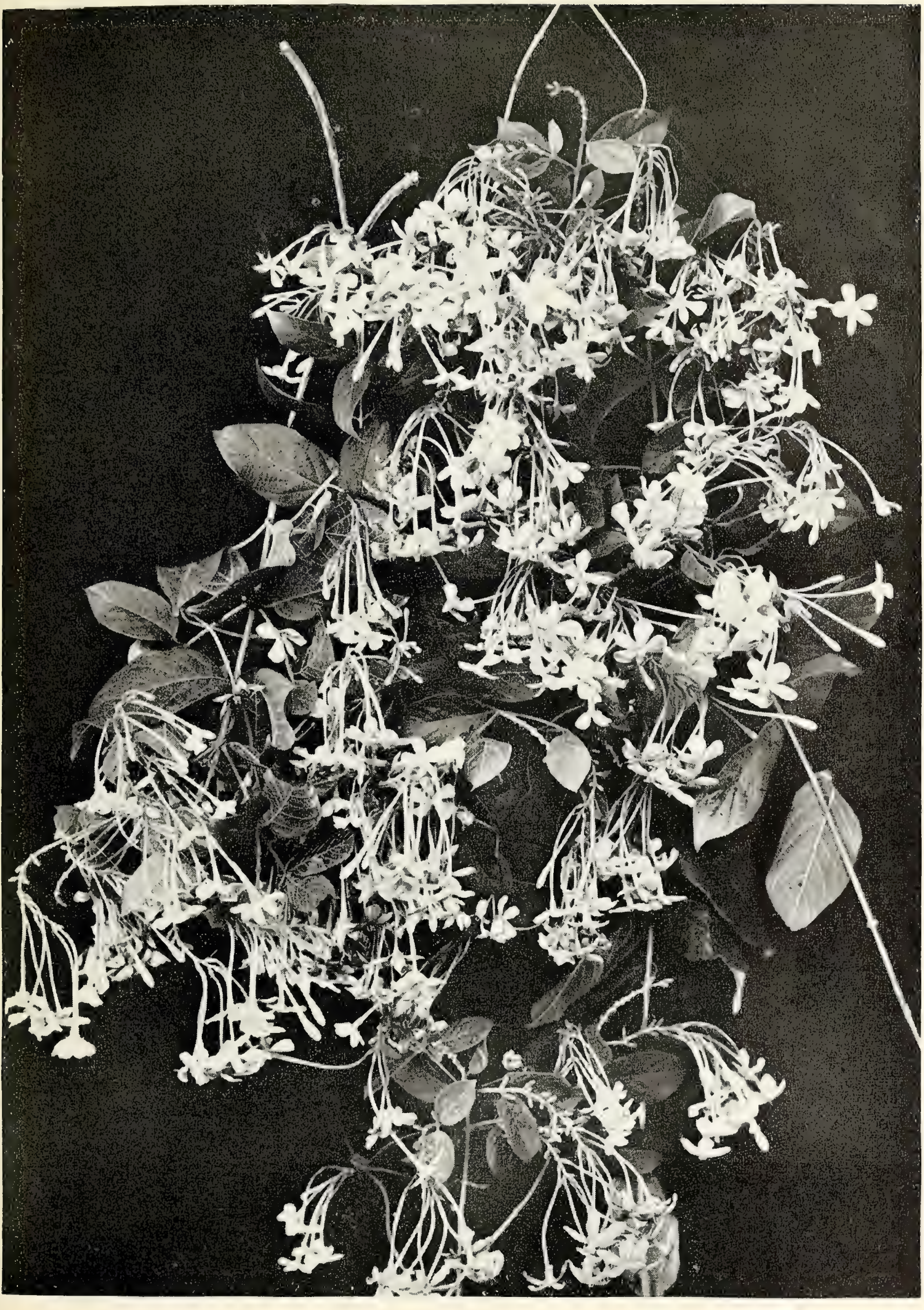


Photo by M. B. RAIZADA.

The Rangoon Creeper.
Quisqualis indica, Linn.
New Forest, Dehra Dun.

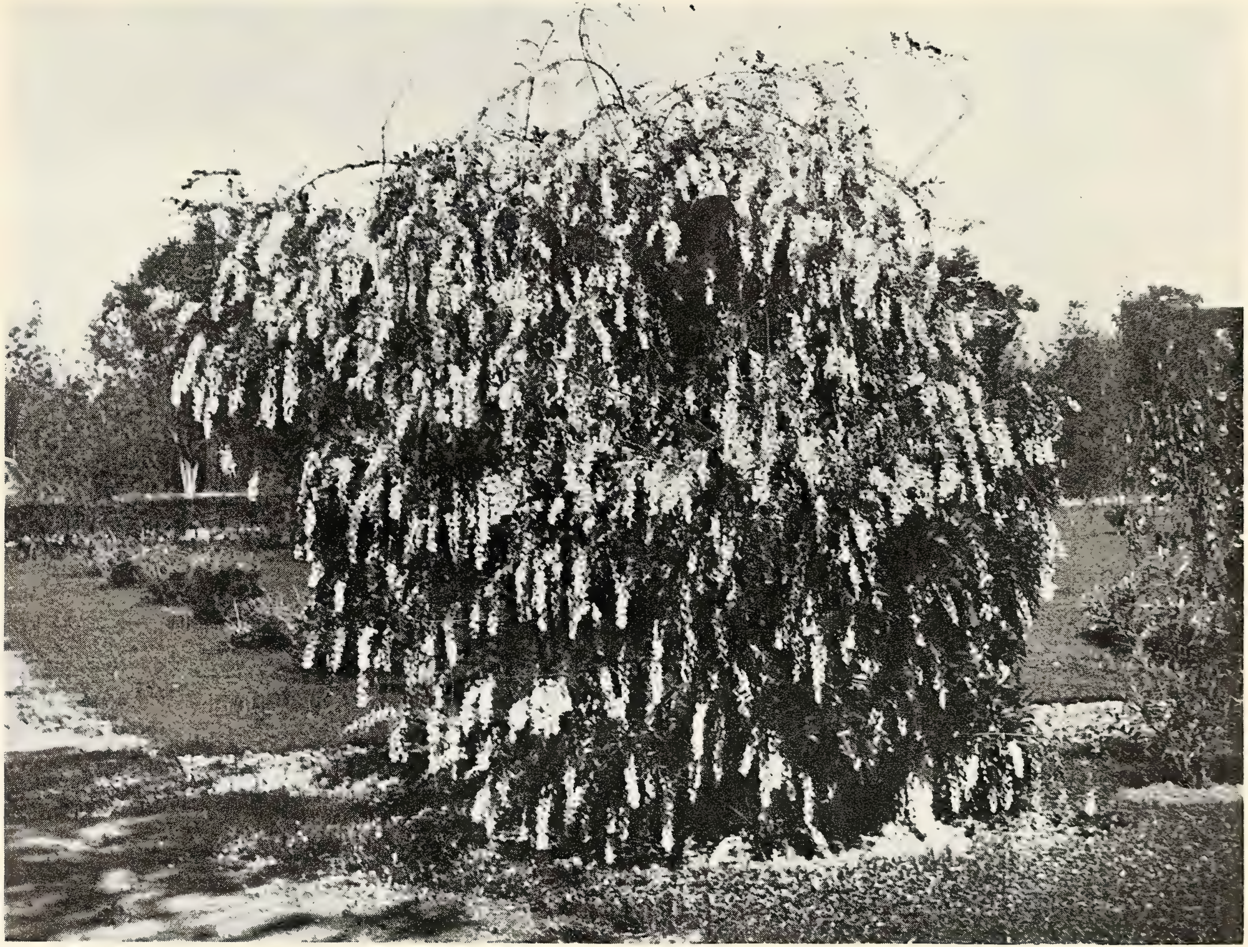


Photo by M. N. Bakshi.

The Chinese Wisteria.

Wisteria sinensis (Sims) Dc.

New Forest, Dehra Dun.

Flowers.—Practically all the year round.

Distribution.—Indigenous in the Malaya Peninsula, the Philippines and Western tropical Africa. Now commonly planted in all tropical and subtropical countries.

Gardening.—A rapid-growing deciduous scandent shrub requiring a strong trellis for its support. In rich soil its growth is very rampant and unmanageable. Consequently it is advisable to cut it back during the dry season. It is constantly in bloom all the year round. The flowers are white, sweet scented, open at night but turning pink at day-break. This mixture of pink and white gives the plant an unique and charming appearance when in flower. Easily raised from layers, cuttings or divisions of the root. It rarely fruits in Northern India.

Wisteria Nutt.

(This genus was called after Kaspar Wistar (1761-1818), a famous Philadelphian anatomist. The name was spelt *Wisteria* by Nuttatt, the author of the genus, and this spelling holds good).

This is a genus of the Leguminosae, sweet pea section. The genus contains woody vines often reaching a great age. The leaves are alternate, compound, odd-pinnate, with 9-13 leaflets. The flowers are in long drooping racemes and may be white, lilac, purple or blue in colour. The calyx is bell-shaped, 5-toothed. Corolla papilionaceous. Stamens 9+1. Fruit a pod, twisted when mature.

The pods of this climber explode when the seeds are ripe and the seeds are flung out. Ridley mentions the results of two observers who experimented with Wisteria in order to see to what distance the seed would be ejected. Haesteal stated that on dehiscence of the pod, the seeds flew 10 feet across a room and struck the window violently. From this he calculated that the seeds would have travelled at least 16 feet. Zabriski says that the seeds were thrown with great force against a window 16 feet away and he judged that this flight would have been 30 feet. The explosion appears to be effected by a layer of strongly thickened elongate cells which runs transversely across the valve and which winds into a spiral when drying.

In the *Gardener's Chronicle* for 1940 appears this account of a Wisteria:

'The specimen was planted somewhere about forty years ago; it covers the face of a building twenty feet high and eighteen feet wide, and rambles into a Yew tree. About four years ago, rats were found to be working at the base, which was about two feet in circumference, and while trying to evict these rodents, I found the old stem was completely rotten at eighteen inches from the ground. I looked at the plant in amazement, as it was still growing and in full vigour. When casting around to discover what had happened to enable it to keep on growing, I found that a branch nine feet up had gone round the corner of the building and *joined* on to another plant eighteen feet away at the other corner, twisting itself round a stem and making a natural graft. This means that the flow of sap must now be reversed, and flows down to the base of the old stem. I have never seen or heard of anything like this, and therefore thought these notes might be of interest.'

Wisteria sinensis (Sims.) DC.

Chinese Wisteria; Blue Rain; Blue Acacia.

(Sinensis seems of Chinese origin and refers to the natural home of this plant).

Description.—A sprawling deciduous vine with a twisted trunk reaching 6-9 in. in diameter and many long whip-like branches. Bark brown, often covered with brown felt. Leaves compound, alternate, odd pinnate, deciduous. Rhachis up to 12 in. long, swollen at the base, grooved on the upper surface and slightly silky, terete and striate. Leaflets 7-11, densely silky when young, when old sparsely covered with silk on the upper surface often very hairy below, margins ciliate, ovate-acuminate, ovate-lanceolate or elliptic in shape, 2-3 in. long, somewhat oblique cuneate at the base, acute acuminate and sometimes even caudate at the tip, ciliate on the margins; petiolule short, .1 in. long, densely hairy, articulate on the rhachis; stipellae subulate, .2 in. long.

Flowers arranged in terminal lax racemes up to 13 in. long which appear with the young leaves, pedicellate; rhachis striate-hairy; pedicel .75 in. long, hairy; bracts obsolete. Calyx bell-shaped, densely covered with short appressed hairs, 5-toothed; one tooth almost subulate, the other triangular acute, larger than the lower. Corolla papilionaceous; standard orbicular-emarginate, or broader than long, clawed, with 2 appendages at the top of the claw, violet-blue or blue in colour. Wing petals slightly shorter than the standard, obovate oblong, violet-blue, tip rounded, base excised with a cusp, claw slender. Keel-petals shorter than the wings, obovate-oblong, almost hatchet-shaped, violet blue, base narrow rounded. Stamens 9+1; the upper stamen from the remaining nine joined by thin filaments; anthers small. Ovary elongate, pubescent, style curved at right angles to the ovary. Fruit a pod, up to 5 in. long, oblanceolate in shape, flattened, narrowed from the upper third to the base, top acute or cuspidate; valves thinly woody, clothed externally with a dense brown velvety pubescence, internally with a thin puberulous white corky layer, twisted after dehiscence. Seeds .25-.5 in. in diameter, orbicular, flattened, dark brown smooth.

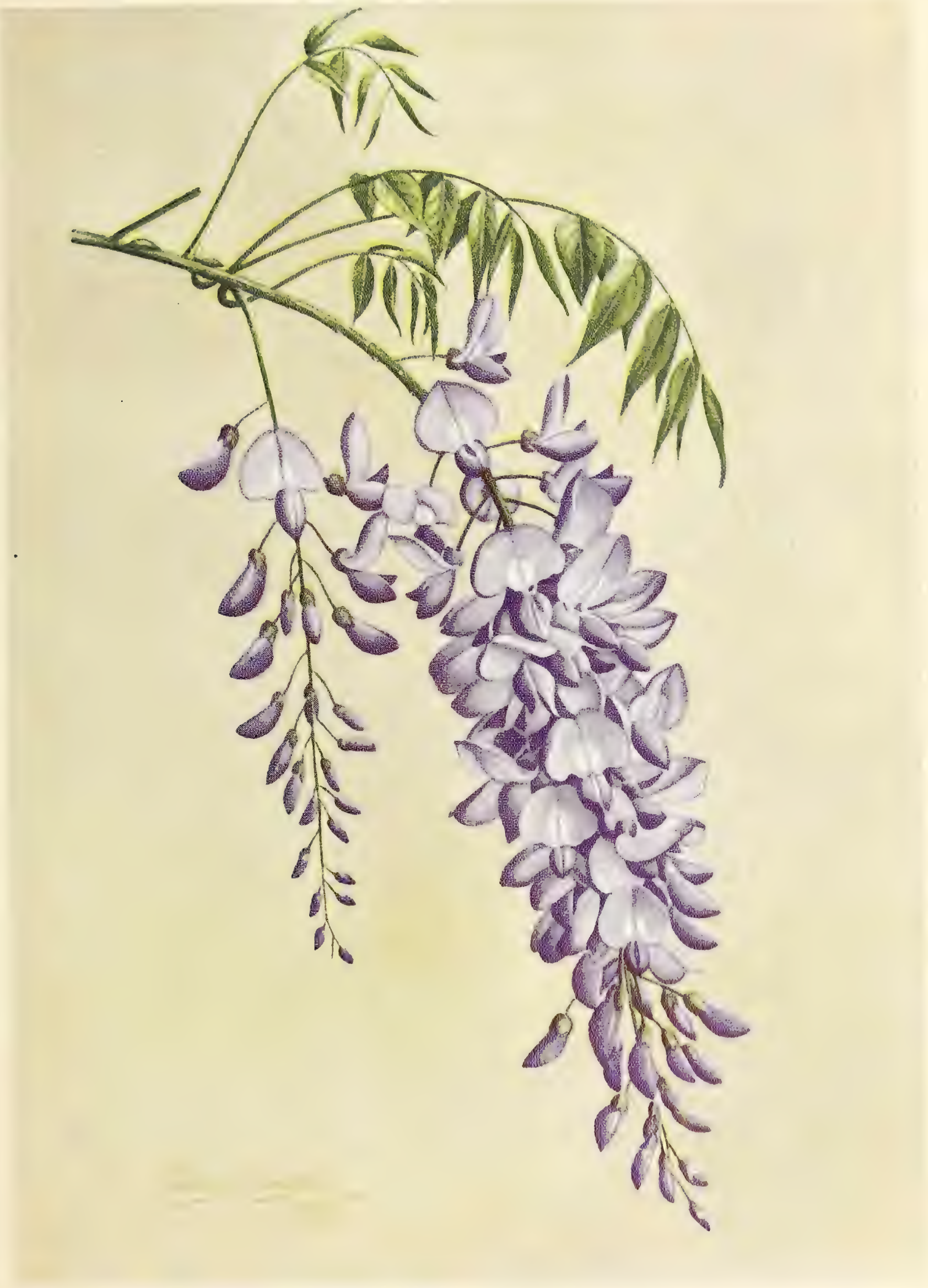
Flowers.—Hot season. Fruits rainy season.

Distribution.—A native of China now widely cultivated in the hills and plains of India.

Gardening.—An attractive, large climbing shrub with handsome foliage and long racemes of large pale-purple or violet flowers. It is very suitable for covering porches, arbors and the like. According to Bailey it is 'the noblest of the woody vines for temperate regions.' This vine succeeds well in Northern India but in the climate of Calcutta it thrives indifferently and at high elevations in the hills it never flowers profusely. Propagated usually by layers as the seeds, though grow readily, do not reproduce the horticultural forms.

Wisteria sinensis (Sims.) DC. Var. *alba* a white flowered variety has recently been imported but it is not so beautiful.

Medicinal and Economic Uses.—A resinous substance and a glucoside have been isolated from the bark of this plant. Both these substances are said to be poisonous but apparently nothing is known of their chemical constitution.



Chinese Wisteria; Blue Rain; Blue Acacia.
WISTERIA SINENSIS (Sims.) Dc.
(Nat. Size.)

NOTES ON SOME INDIAN BIRDS

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

IX—EAGLES, OWLS AND VULTURES.

(With 10 plates from photographs by the author).

(Continued from page 373 of Vol. xliv *No. 3).*

The rough notes for this article, and the photographs illustrating it, recall to my mind a host of memories, many happy, others not so pleasant: memories of delightful Christmas weeks spent in camp with friends who were friends indeed; of buttressed red cotton trees, huge and leafless, but from the flowers of which numerous birds obtained sustenance which, judging by the noise they made, was a dish fit for the gods to consume. I am reminded too of the mumbling call of the dusky horned owl as my wife and I arrived home from our evening walks when it was almost too dark to see, and of quite fierce attacks made on myself by some of the smaller birds of prey as I approached their nests; nor can I forget vile smells and revolting sights that nearly turned me inside out, or the magnificent views obtained from several of the eyries visited. But if there is one memory that stands out more prominently than all others, that memory is of pylon-like *machans* sixty feet and more in height, very rickety and given to groaning and creaking and bowing to every puff of wind—or so it seemed to me enclosed in the small hiding tent at their summit. So much did they sometimes sway that when a gust more violent than usual shook us, involuntarily I seized the end of the platform furthest away from the direction in which I felt we were going to collapse. Now only, as I look back to long sessions in those frail and attenuated watch-towers, do I realise the folly of my conduct in remaining in them.

The word eagle is used here for convenience only to embrace those diurnal birds of prey with which I have had photographic acquaintance. And there is not a better one to start with—it was also the first I photographed—than the sparrow-hawk-like shikra which is so common about gardens, villages, groves and light scrub jungle. No etymologist, I am under the impression that shikra is but another form of *shikari*, a hunter; and a hunter in the proper sense of the word is the shikra—not, it is true, of big game but of lizards, rats, small birds and insects though I have seen it give chase to and finish off a ring-dove, in size almost equal to itself. Its method of attack is to disappear into some heavily-foliaged tree and when its presence has been forgotten, to dart down on to a sparrow or other small fry feeding on the ground below and carry off the unsuspecting victim to some other tree before it has had time to realise what has happened.

The shikra breeds between the second half of April and the middle of June. The nest is a small twig affair, cup-shaped and about eight inches in diameter, and is unlined. A departure from the ordinary which came under my notice was a nest made entirely of pieces of wire, the kind of nest that the house crow often makes. Three or four eggs are laid—I once came on a clutch of five. Both sexes help to build the nest but I have never had the good fortune to see whether the male and female incubate—it is stated that only the latter does so. Both birds feed the young though this job devolves more particularly on the female, the male devoting himself generally to bringing food to the nest. Both sexes are often, though not invariably, bold in the defence of their home, whether this contains eggs or newly-hatched young. On several occasions have the owners of a nest flown at me, without, however, actually striking.

In a previous article *'Birds in my garden'* I have said about all that there is to be told concerning the common pariah kite. Like the shikra, this species has attacked me when examining its nest, contact actually being made. But the kite, like other species, varies in its behaviour and often I have not been worried by the bird at all.

Reading through my notes, two instances occur which seem to indicate that the kite sometimes thinks or appears to do so. The first concerns the manner in which during two successive seasons, at the same tree and therefore not improbably the same bird, a member of this species flew at a leafless twig of a *siris* tree in my compound, the approach in each case being made at a level with the twig from a distance of about ten yards. As the twig was reached the bird dropped its feet, and without halting, carried away in them the portion broken off by the force of the impact. The impression I obtained each year was that the kite *knew* that the twig was dead and that an addition to the nest could be obtained in this manner.

The second instance was brought to my notice by my wife. As already indicated, my old compound at Tundla was patronised for roosting purposes by large numbers of green parrakeets. One morning, when the birds were beginning to disperse, my wife observed a kite swoop down repeatedly to a tree. Each swoop caused a number of parrakeets to leave the tree. The kite, however, did not stoop at the parrakeets in the tree; instead it passed to the side of and beyond the tree and then under the several telephone wires, in the direction of which the parakeets invariably flew, the bird's obvious intention being to seize any *tota*—disabled by striking the wires (I have shown that the parrakeets frequently struck these wires). While we watched we did not see the kite meet with any luck, but elsewhere I have found a full-grown dead green parrakeet in a kite's nest containing young, and possibly this was how the meal was obtained.

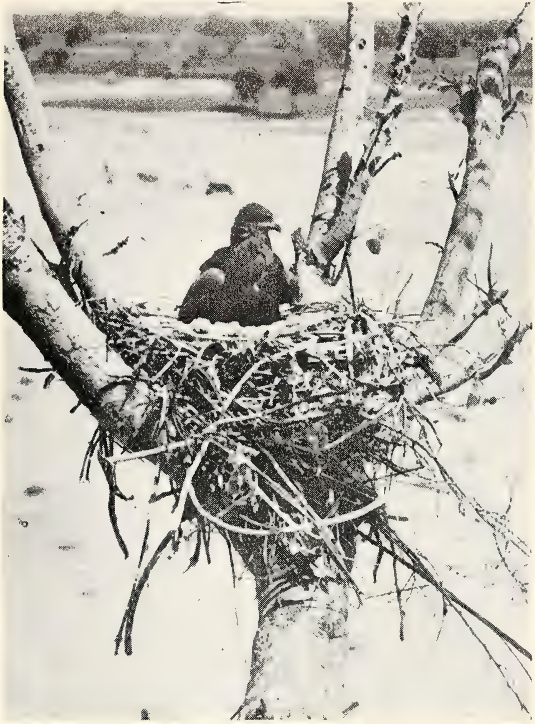
The brahminy kite, reddish-brown in colour except for the head, neck and breast which are white, and with a rounded tail, obtains its livelihood by quartering *paddy* fields, canals, *jhils* and river-*ghats* for frogs, small fish, crabs or any other flotsam or jetsam that may come its way. Like the pariah kite, the brahminy breeds early in the year, and there are few species more bold in the defence of their *lares et penates* than is this species. Of the brahminy kite I think I can say, that *always* it has attacked us when we have climbed to its nest, or busied ourselves building a tower from which to photograph the bird; and always it has struck home and usually drawn blood.

During an afternoon spent in photographing the brahminy kite I found that the two young were fed at intervals of roughly one hour,

1. *The Shikra.*

2. *A Shikra's Nest.*

Photo by E. H. N. LOWTHER.



Common Pariah Kite.

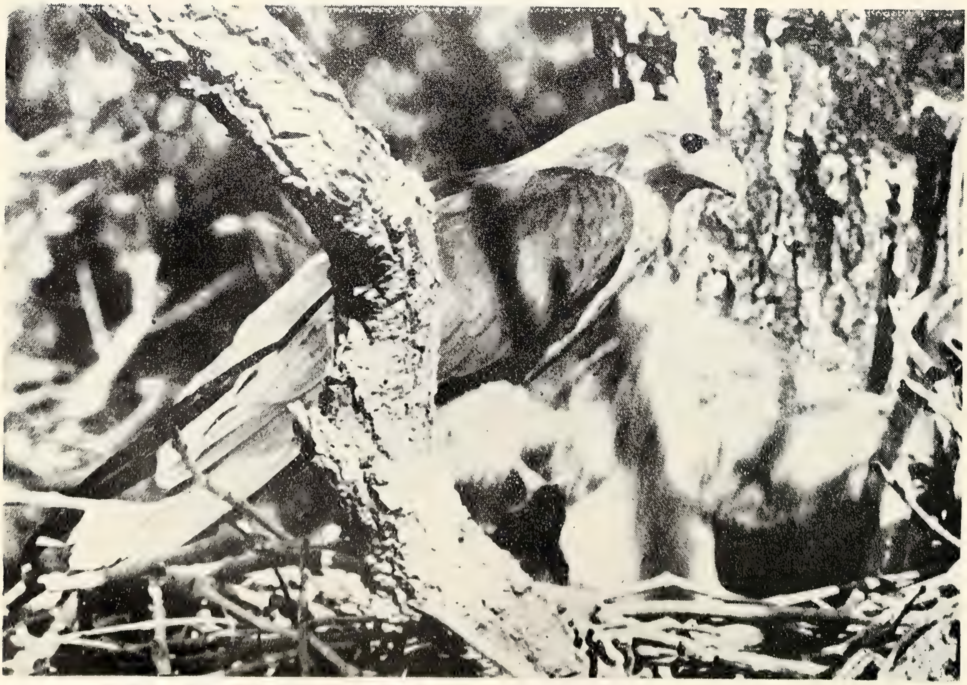


Photo by *Brahminy Kite.* E. H. N. LOWTHER.

the food brought being frogs only. The female tore off small pieces and gave them to the young which were still small. Both parents brought food, but only the female did the actual feeding. The young seemed to be greatly worried by flies which, without doubt, were attracted to the nest by the remains of many a 'high' tea!

The *simal* tree in which the laggar falcon had its nest was one of the highest I ever climbed. The nest was a previous year's effort of a pair of white-backed vultures, the latter having built a new nest a few feet higher up. This, at the time of my first visit (8th February) contained a small young one while in the laggar's nest were four beautifully marked eggs, large editions of those of the kestrel. At the foot of the tree, in a prickly bush, a ring-dove was sitting on her two eggs, and round about were scattered the feathers of many birds, chiefly green parrakeets. The falcons took no notice of the vultures at the nest but chased them unmercifully in the air. Particularly offensive were they in their behaviour to a king vulture which happened to soar overhead, the huge bird having to side-slip by turning completely over on its left and right side alternately in order to avoid the attacks.

Building the *machan* to the laggar's nest, and climbing up and down it, as well as the time spent in the hiding tent, was, to say the least, exciting work as hanging from under two branches of the tree were large swarms of the dangerous black bee. Always we carried thick blankets in case we were attacked—now I come to think of it, I am afraid these would have been of no avail—but fortunately the bees did not regard us, perhaps because of the particularly silent manner in which we invariably worked here!

When I visited the laggar's tree on the 3rd of March, the nest contained three young ones about ten days old, and an addled egg. While previously the falcons had been somewhat conspicuous by their absence, although on one occasion both birds alighted high up in the tree, when the male passed some small bird over to the female, after which both flew away together, now they were very much in evidence and flew at us repeatedly, both on the ground and when on the *machan*, shrieking at us at the same time.

When I had been in the *hide* about an hour, the female laggar sidled along a thick branch to the nest. She brought no food but this did not prevent the young from mobbing her furiously: perhaps it was because she had come empty-handed that they treated her so. Be the reason what it may, the treatment was more than the parent was prepared to put up with, and presently the old bird ran along the aforesaid branch to a distance of about four feet from the nest, from where she was able to survey her young in peace.

During this watch the male brought what I took to be a bulbul, already dressed, to the nest. He did not stay for more than a few seconds but it was long enough to enable me to take his photograph—and beautifully posed he was too. After his departure the female returned to the nest and tore off tiny pieces of the bulbul's flesh and gave these to the young. The feeding continued for about 5 minutes when she suddenly flew away. Thereafter two of the youngsters fed themselves for a short while but did not seem particularly interested in what had been provided.

I took two photographs this day and had every reason to hope they would be successes. Alas ! when I developed them that night I felt like kicking myself—or worse. One side of the double dark slide was empty and the other had in it a plate on which I had already taken a group photograph ! I suppose accidents such as this will always happen, and they undoubtedly do good because they make us more careful for some time. None the less they are very annoying. As a result of my stupid carelessness I have only the one picture of the laggar to show for all my hard work—and some will say that I do not deserve even this.

The tawny eagle, like so many of the larger *Raptores*, often brings up its family early in the year. Nidification continues, however, till May or even June. The nest is large and may be built twenty or twenty-five feet from the ground, or double that distance and more. At whatever height it is situated, it is invariably placed on the extreme top of a tree so that the birds may land and take off without having to pick their way through branches. Two eggs are usually laid, greyish-white in colour, with or without a few red or brown markings.

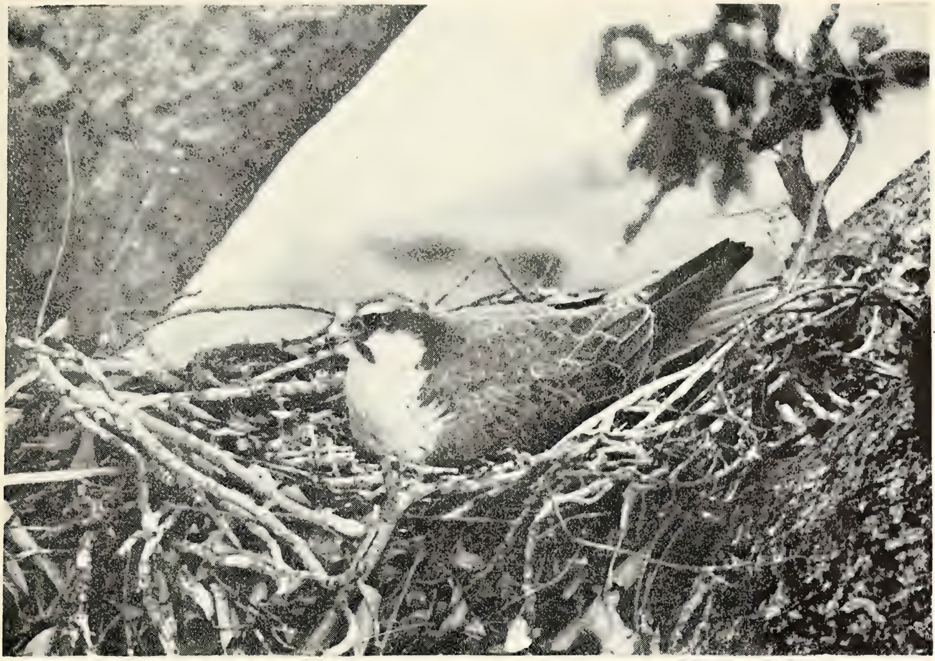
I have never known a tawny eagle show fight when a human being approached its eyrie, but Dewar records seeing one seize and carry off the turban of a man who had removed the eggs from a nest. Such conduct must, I consider, be very exceptional. Certainly the tawny looks fierce, but there, to my mind, the eagle tradition ends, as it is a great feeder on carrion and usually kills small birds and even lizards and insects in preference to tackling something larger and more in keeping with its size.

In his *Popular Handbook of Indian Birds*, Whistler gives Bonelli's eagle only an ' honourable mention '. He dismisses it with these remarks: 'Another very courageous bird of similar size and appearance (to the crested hawk-eagle) is Bonelli's eagle which is found sparingly throughout India. It has, however, no crest.'

I do not know who Mr. (*Signor?*) Bonelli was, but the fact remains that his name gives no idea of the bird itself. The alternative name suggested in recent years for this species by Mr. Stuart Baker, the slender hawk-eagle, is far more appropriate as Bonelli's eagle is a hawk-eagle, more stream-lined in build than an eagle and with a longer tail; and hawk-eagles, while every bit as courageous as eagles, are not given to feeding on carrion as many eagles are.

Though it occurs throughout India, Bonelli's eagle is not a common species. In the plains I have met with it only in Hume's old haunts, round about the Jumna and Chumbal rivers in the Etawah district, and in the Topchanchi area in Bihar. Its colouring is difficult to describe as this varies considerably. Perhaps ' umber-brown above; lower plumage buffy-white, with much dark streaking; long wings, and long *tarsi* feathered down to the toes' describes it as well as anything, if we add to the description the fact that the eye is a golden-yellow.

Bonelli's eagle builds its enormous stick nest either on a ledge of a cliff or on some large tree—I have seen the nest in both situations. Eggs may be found about the end of December and throughout January and the first half of February. These are usually two in number, greyish-white in colour, with some light red or brown blotching.



1. *Laggar Falcon.*

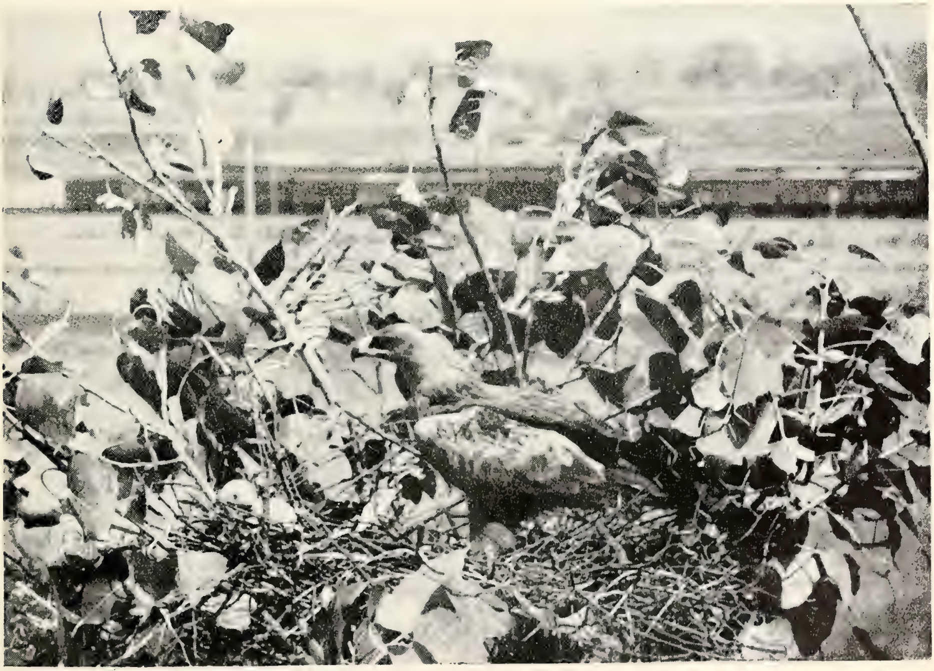


Photo by

2. *Tawny Eagle.*

E. H. N. LOWTHER.

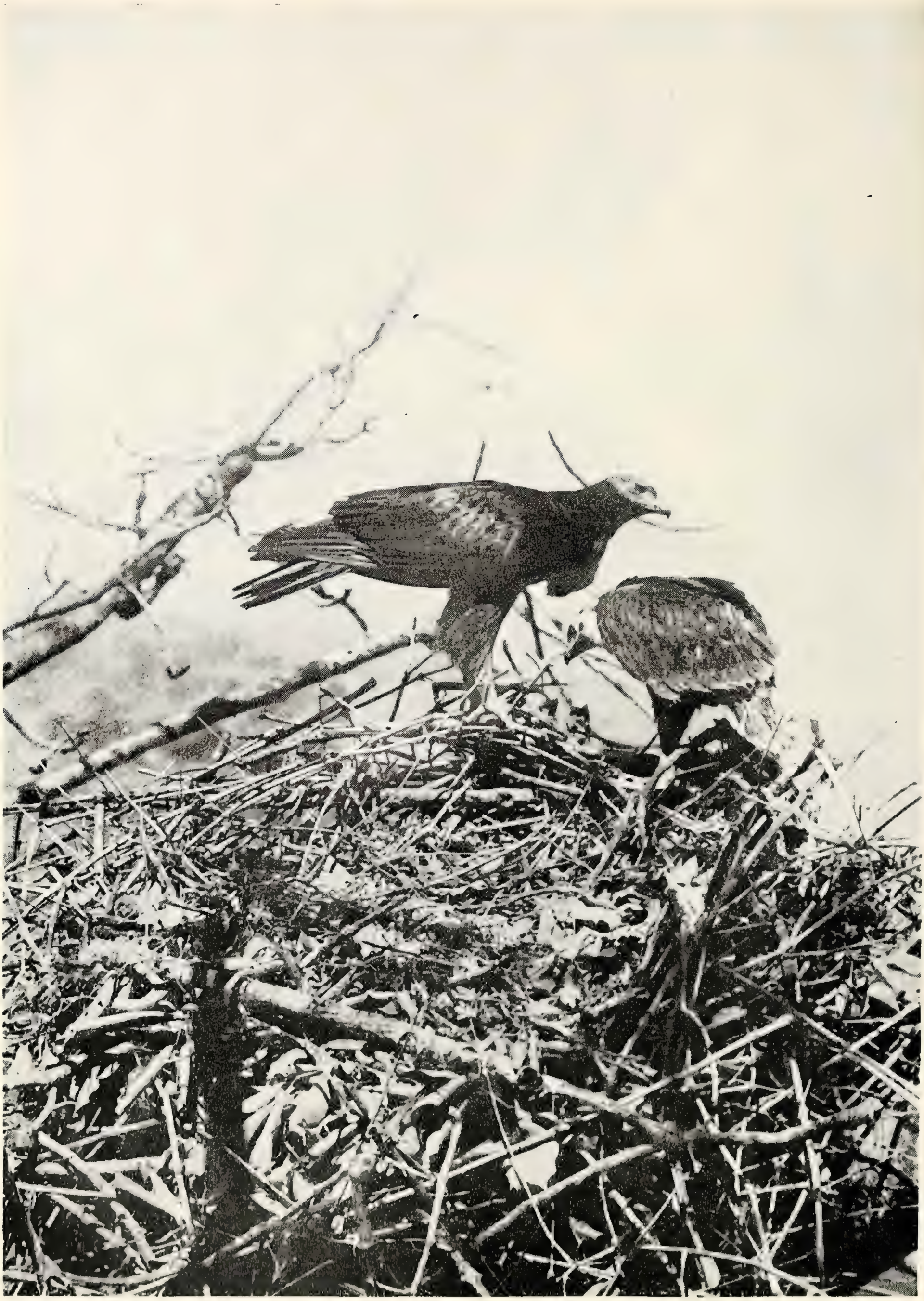


Photo by E. H. N. LOWTHER.

1. *Slender Hawk-Eagle* (*Bonelli's Eagle.*)

The nest at which my photographs were obtained was built on a gigantic *simal* tree at the head of a steep *nala* in mixed bamboo jungle. My *shikari* told me the eagle nested here every year, but that the nest then in use was a new effort as the old one had fallen down during the previous monsoon. Even so, the new home was of colossal size, about four feet in length, three feet wide and more than a foot deep. The branches forming the base of the nest were quite two fingers thick, and many of them had been broken off with foliage attached. Consequently the nest was well lined with leaves; and during the three watches I had in the *hide*—on 17th and 25th February and 10th March—more branches with leaves adhering to them were brought by both eagles.

At the time of my first visit the young one—a singleton—was probably between two and three weeks old, and was still a ball of white down with traces of feathers appearing in the wings. Later the feathers showed in the tail and about the shoulders. At this early stage, the young hawk-eagle spent most of its time sleeping, or sitting still with chin resting on a twig, but looking anxiously towards the skies. Occasionally it toyed with a leaf or pecked at a small piece of dried flesh which had worked its way in between the twigs. Sometimes the young eagle moved about on the nest, using the 'shoulders' of its wings to help its progress. Its crop at the time was full—an indication to the photographer that the parents were not likely to visit the nest for a couple of hours or more. At the end of this period, both eagles came into view, circling round the tree a number of times. One only had any food—this turned out to be the male, who presently alighted at the edge of the nest with apparently a young partridge which had already been 'dressed'. He remained only two or three seconds, his place, as soon as he had gone, being taken by the female who fed tiny pieces of meat to her offspring. The young eagle was, however, not hungry, and seeing this, the mother bird left her child to its own devices.

About an hour later the male eagle was seen approaching with a twig held in his feet. Again he circled round before alighting on the nest. He left in a great hurry, taking the twig with him. After another hour or so he returned, again with a twig, but this time with one with foliage still on it. This was deposited on the nest, no attempt being made to work it into the structure.

After her futile attempts to feed the eaglet, nothing was seen of the female until I was on my way home, when both eagles were observed soaring round and round the *nala*, the male with something in his talons—a tree-rat I thought. From what was noted now, as well as subsequently, it appeared that the male was chiefly responsible for obtaining the food and the female for giving it to the young bird. A male painted spur-fowl was brought by the female on one occasion, other victims (of the male) being a glorious cock red jungle-fowl, and a barn-door chicken.

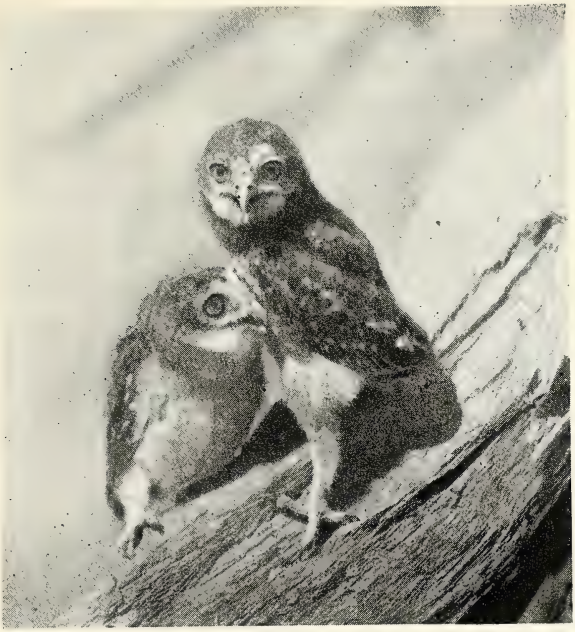
On the occasion of my second session in the hiding tent, the young eagle was very hungry and squealed as soon as it saw food being brought. This it ate with *gusto*, refusing nothing that was given. The way in which the mother eagle tore off pieces of flesh was astounding; joints she dealt with as though they did not count, Gristle, bones and entrails she ate herself; the flesh, in small pieces, was given to the eaglet.

The last time I visited the eyrie, the young Bonelli's eagle had grown considerably and was indulging a great deal in wing exercises, though it probably did not leave the nest for another three weeks. On this occasion I was accompanied by my wife who had taken out a sumptuous picnic-lunch which, however, we were fated not to partake of till tea time, after we had left the eagles in peace, as eggs, butter, bread, cheese, cutlets, everything was wrapped in the crinkliest of crinkly paper, to open which made such noise that I insisted no more could be opened, as no self-respecting eagle would tolerate such a din near its nesting-tree. Hard indeed is the lot of a bird-photographer's wife!

Pallas's fishing-eagle builds its nest on the banks of rivers and by large *jhils*, near the top of some enormous, isolated tree. It is the commonest of our large eagles—about the size of the golden eagle—and is more easily identified than any other species on account of the dark brown colouring of the upper plumage as well as of the wings and tail, and the sandy-coloured head and neck. The lower plumage is a lighter shade of brown. In the tail is a distinctive wide, white band. Identification is made easier still by the loud call. This can be heard at a great distance, and may be uttered from the nest, a perch, or high up in the heavens. The call has very aptly been likened to the unpleasant, shrieking noise made by a heavy, ungreased cart wheel. The nest is a colossal affair, and is used for a number of years if the birds are not molested. Nesting commences rather earlier than with most eagles, and eggs—usually two, sometimes three—may be looked for about the first week of December.

More has been written regarding the life and nesting habits of Pallas's fishing-eagle than of any other Indian *Raptor*; and there is little to add which is original. I have photographed the bird at two different eyries, and watching it carefully from a distance of less than twenty feet I have thanked my lucky stars I was not in its clutches: at this range one obtains an impression of terrific strength. In one nest were five small mud turtles; the shells of many others lay scattered about the foot of the tree. A fish, which I judged to weigh between four and five pounds, was also brought to this nest by the male. At the other nest, during the two days I spent in the *hide*, the young were fed entirely on a fish diet, the *male* on one occasion feeding the young for several minutes. Incidentally I missed obtaining a superb picture of the eagle as it was about to alight at this nest owing, in my excitement, to my turning the focussing screw in the wrong direction when I saw the great bird swing into the reflex mirror—every primary in the wings is clearly visible in the negative as also is the white band in the tail, which is spread like a fan, while the sandy-coloured head and neck are unmistakable. The wings are held well above the body, and the feet have been dropped, but alas! the bird is out of focus.

The view from this *machan* was one of the most wonderful I can recall—the Jumna with its wide, white sands stretching in graceful curves away to the east, and ten miles away to the west, that 'dream in marble', the *Taj Mahal*, showing up faintly. Half a mile downstream, a ferry plied, transporting passengers as well as ponies and



1. *Young Spotted Owlets.*

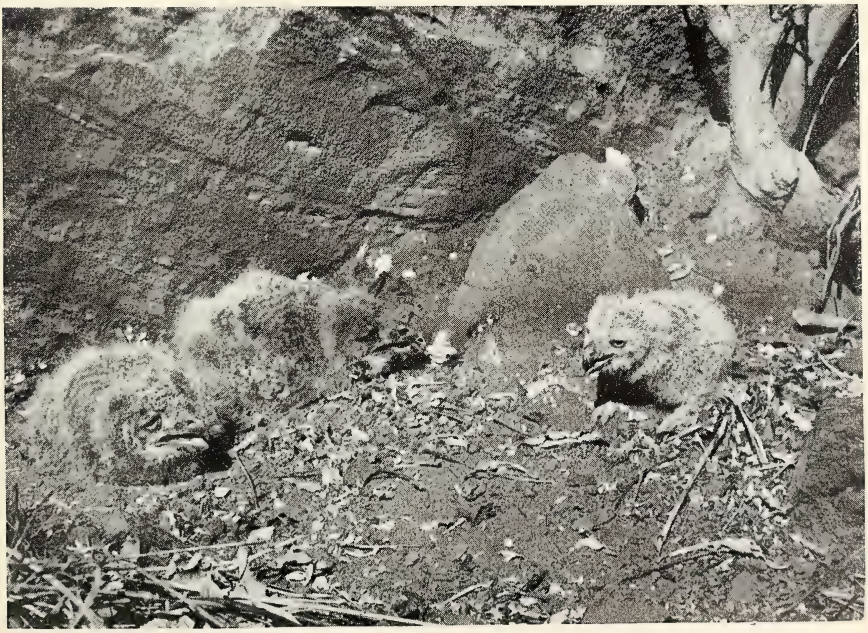


Photo by 2. *Young Rock Horned Owls.* E. H. N. LOWTHER.

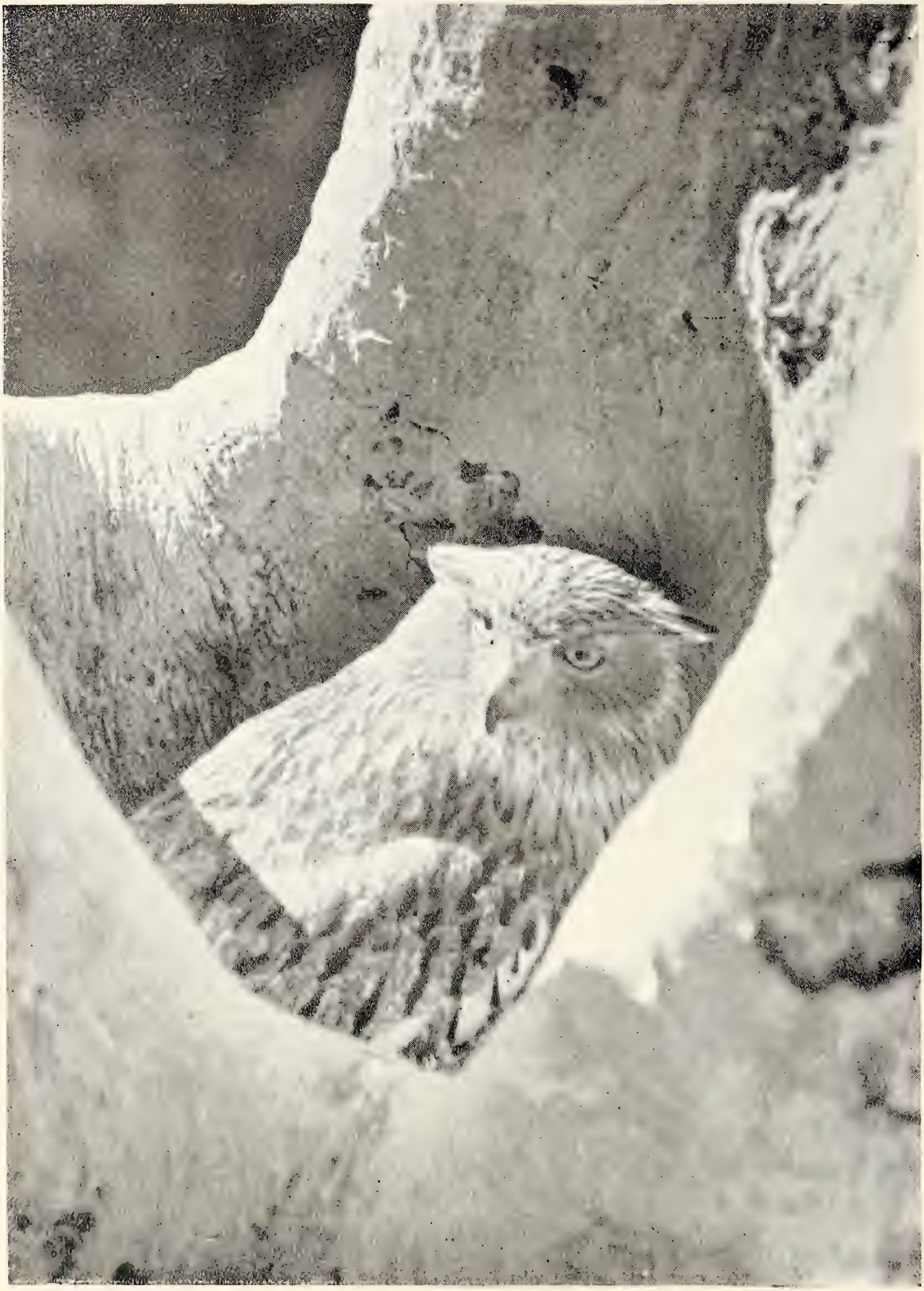


Photo by *Brown Fish Owl.* E. H. N. LOWTHER.

cattle, to and from either bank, and a short distance upstream, late in the evening, a herd of black buck came down to drink.

Elsewhere (*An Indian river-bed*) I have told of the damage done by a Pallas's fishing-eagle among nesting terns. Once, in the Mainpuri district, I saw a considerable nesting-colony of painted storks entirely decimated by a pair of these birds: they just carried off a squab when they wanted one—many of them well grown. Only the breast seemed to be eaten. I do not think one young stork survived: and yet I was told by the headman that the same thing happened every year.

In spite of the fact that Pallas's fishing-eagle is given to a carrion diet—I have seen a human arm brought to a nest, and in another nest found the skull and complete spinal column of a human being—it is also a great hunter and many a sportsman has had his wounded goose, duck or snipe carried off by one of these birds. But Pallas's eagle does not chase wounded game only. One morning a friend and I watched a pair of these birds mark down a coot, which they probably intended to give to their young. Up and down they chased the particular bird, which dived as the eagle closed on it. As soon as it came up the coot was chased again, and would undoubtedly have fallen a victim to the eagles had not one of my beaters secured the bird for himself. Not even scratched, the coot was too tired to elude capture. It was this same day that I saw what few have been privileged to watch—about half a dozen green pigeons on the ground, drinking.

One other eagle I have photographed—the small spotted eagle. Its nest was built in the fork of a tree in thick jungle on the lower slopes of Parasinath hill, and the time of nesting was the beginning of July, when the thick jungle and the leafy carpet under foot was a living mass of mosquitoes, voracious pests which a big game *shikari*-friend who accompanied me described as being 'as large as elephants and as fierce as tigers'. So savage were their attacks, that on subsequent occasions a flit-gun and a tin of flit accompanied us; and even then we were far from free from their attentions.

The few photographs obtained were not particularly successful and since there is nothing of special interest to record concerning this eagle's behaviour at the nest, nothing that cannot be ascribed equally well to any of the other eagles already dealt with, I will pass on to the nocturnal birds of prey, the owls.

Our commonest owl, whose cackling chortles and squawks are to be heard every evening in our gardens, is the little spotted owlet. Strange it is that while in Europe the owl is regarded as the emblem of wisdom, in India its learning is decried; so much so that a fool is often referred to as an *ooloo ka bachcha*—the offspring of an owl. This thought was uppermost in the mind of my dear old *shikari*, Pokhi—now alas! gone to his fathers—when, after I had failed for the second time to obtain a single photograph of the spotted owlet at the nest, he remarked: 'But the owl is *not* a fool, *sahib*—it is a *very* clever bird'.

Although I have failed in my dealings with *Athena brama*, I have been more successful with our larger owls, all fine birds, and all distinctive in habits as well as habitat. The first of these to fall a victim to the prying eye of my camera was the rock horned owl.

Not uncommon in suitable country, the rock horned owl is partial to rocky hills covered with light jungle, and ravines and cliff banks about rivers. Nowhere have I met with it so often as on the hills in the neighbourhood of the Topchanchi reservoir in the Manbhum district—every one of them, *Sikda pahar*, *Mungur Ghar*, *Keshmi*, *Siringi*, etc. had its *quota*. Nesting begins about the middle of November, or a little later, and eggs may be found till the end of January. These number up to four, though two or three usually constitute the full clutch, and are laid on the ground, in a hollow under a rock. I do not remember visiting a nest that contained young, alongside of which there was not at least one rat—they are the rock horned owl's favourite food. In the nest are always the small bony remains of many rodents: they can be seen clearly in the photograph. The colour of the young in down is influenced (by contact) by the nature of the neighbouring soil: in the Manbhum district the young look reddish, in Kashmir a dark rock-grey, and amongst the cliffs of the Jumna and Chumbal rivers a light earthy colour, like *kanker* dust.

The call of this owl, heard after sundown and throughout the night, has been variously described as a 'resounding *bu-bo*, the second syllable much prolonged' (Sálim Ali), 'a loud *dur-goon* or *to-whoot*, solemn and deep in tone' (Whistler) and 'a loud *hoo*—slightly drawn out, but still a single note and not dissyllabic' (B.B. Osmaston). I have noted it as ' a loud *hoo*, somewhat prolonged, but not unduly so. Sometimes this is followed by a short cackle'. On another occasion, listening to one on a very wet night from my bed on a house-boat, I described it as '*hoo*—short—followed two or three seconds later by *tu-hoo*'.

The rock horned owl is not an easy bird to photograph—in the first place it is 'clever' (to use Pokhi's term), and next the terrain usually prevents the hiding tent being erected at a convenient level or distance. If, however, a suitable nest is found and more than usual caution exercised in erecting and camouflaging the *hide*, and a couple of days be allowed to pass before entering it, there is no reason why successful photographs should not be obtained. And if 'the man behind the gun' does not have high blood pressure when the great owl alights by her nest he is not likely to suffer from that dread of present-day life.

When left undisturbed, the rock horned owl breeds in the same spot every year.

I have said that our larger owls are distinctive in their habitat. There is no denying the fact, however, that the type of country that the rock horned and the brown fish owl frequent is identical in one respect—when they live about cliff banks and ravines near a river. Nevertheless the brown fish owl is more generally found in well-wooded country, near rivers and canals. At close quarters it can be readily distinguished from the other 'horned' owls by the absence of feathers on the *tarsi*, by its general tawny-brown colouring and the fact that its 'ears' are held nearly horizontally, as opposed to the vertical position assumed in the case of the rock horned and dusky horned owls.

Sometimes the brown fish owl appropriates the old home of a

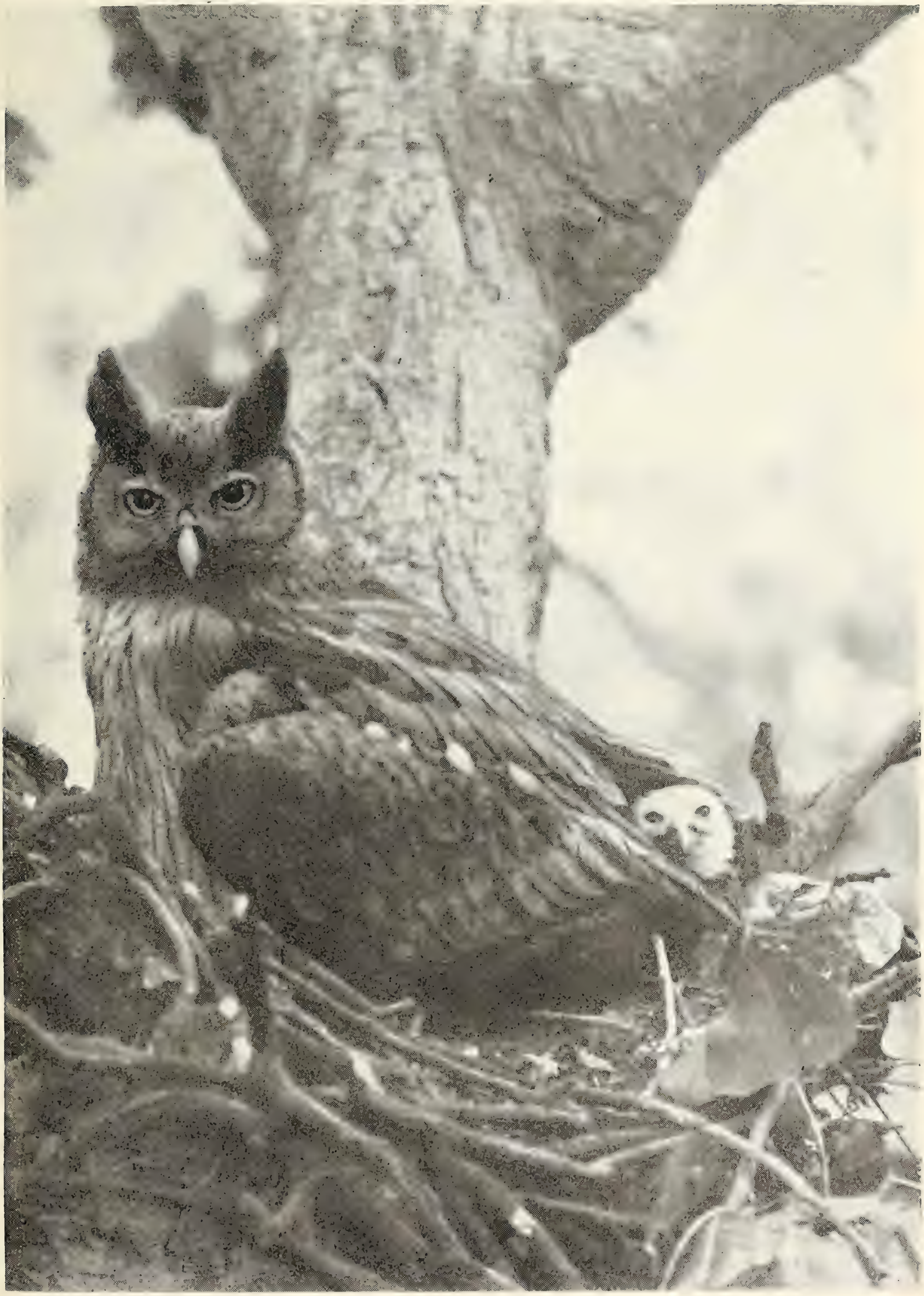


Photo by Dusky Horned Owl. E. H. N. LOWTHER.

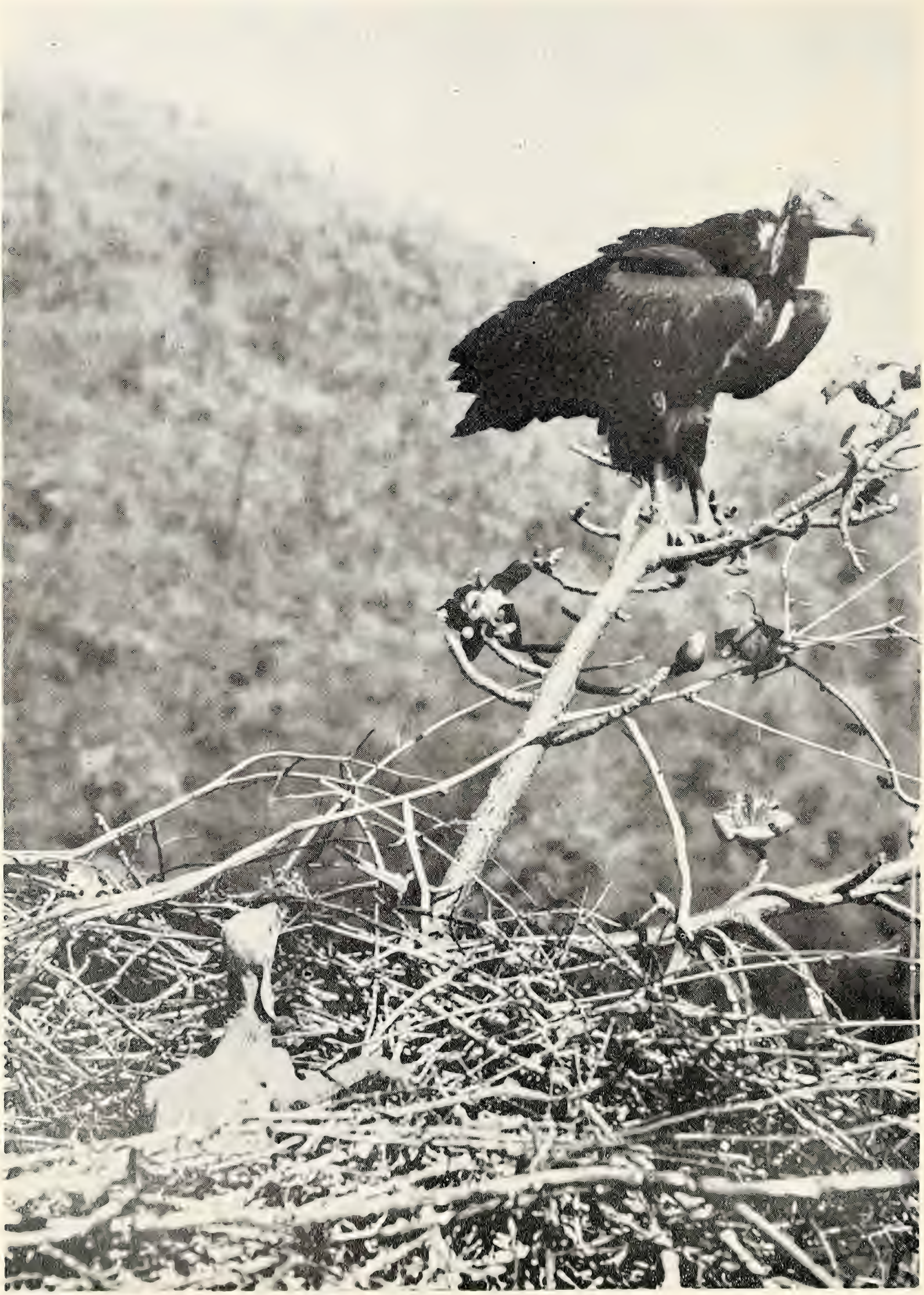


Photo by King Vulture. E. H. N. LOWTHER.

vulture or eagle for nesting purposes; usually, however, it lays its large, white, round eggs, one or two in number, in a depression of a tree where two or more large branches radiate from the trunk. These rest on a layer of dead leaves or other rubbish accumulated by chance. Always the nest appears to be in the vicinity of water, its presence necessary for the bird to obtain its main livelihood—fish and crabs. Most eggs will be found in January but the bird illustrated laid its first egg on Christmas Day and the second two days later.

No nest could have been better situated for my purpose than this—it was in the hollow of a large *siris* tree in a Canal Department bungalow compound at which we were spending *Burra Din*. More fortnunate still, the hollow could be overlooked, and at certain times of the day, for short periods, was sun-kissed.

Needless to say, I was quickly at work. The *machan* was a small one, about fifteen feet high and thoroughly comfortable. The owl flew off as I climbed to the *hide*, and returned to its eggs about forty minutes later, its return, then as always, being made known to me by the chattering of seven sisters and the screams of green parrakeets, which appeared to follow the bird on its way back to the nest. Always in a hurry to cover her eggs, once at the nest, the owl on one occasion only sat facing me; and then her head was rather too low down to make a really good picture. Quiet noises produced through my lips made the bird look in my direction, and during the four periods spent in the *hide* a good series of photographs was obtained including one showing the owl's bare, featherless feet, and another of her having 'forty winks'. It was amazing how, with her back to me, the owl was yet able to turn right round to look at the lens without moving her body at all.

On one occasion a palm-squirrel ran up on to the far rim of the nest-hollow. It did something like 'evens' to disappear when it caught a glimpse of the owl's cat-like features.

Whether it is so or not the dusky horned owl always *appears* to me to be the largest of the common 'horned' owls—not much larger but just that little bit that makes all the difference; and it occurs equally generally as the others. It frequents avenues of large trees along our main and side roads in the country, as well as groves around villages, and occurs even in the public gardens of large cities—one or two pairs live in the grounds of the *Taj Mahal* at Agra, and in the *Dilkusha* Park at Lucknow. It is rather a dark grey in colour, and where one bird is seen seated towards the top of some tall tree, well concealed, the pair will be found not far away. Most often, and this is particularly the case during the autumn and winter months, although when sleeping out I have occasionally heard it at the dead of night during May and June, this owl's presence is first made known to us by its call, heard towards dusk and repeated at intervals during most of the night, sometimes for minutes together, with short pauses in between. Commonly the mate gives answer in similar tones. To me this call sounds like *gru-gur—goor-gru-goo-goo*. Others have likened it to the noise of an engine in the distance hauling a train up a heavy gradient; but perhaps the best rendering of it is that given in the *New Fauna*—'a low, deep rumbling *woo-woo-woo'*, just as though an old man were mumbling something.

The dusky horned owl sometimes builds a nest for itself—a stick affair. Normally, however, the bird appropriates the old nest of some eagle or vulture. It was at such a nest, one high up in a *pipal* tree in which a white-backed vulture had earlier in the year brought up its young one, that my photographs were taken. The nest was a very dilapidated one and contained two eggs on 7th December. A month later a platform was built in the tree for the hiding tent, and ladders lashed to stout branches to facilitate my ascent.

I spent 10th January and 9th February in the *hide*. The female flew off the nest as I started climbing, and the male, perched in the next tree, followed suit a minute later, both settling in some mango trees in another small grove a little way behind me, as I could tell by the cawing of crows and chattering of other small birds. In the nest were two white, downy owlets, one smaller than the other.

For an hour or so nothing happened except that I was kept in a constant state of fear and trembling lest the younger owlet should fall over the side of the nest: for what seemed countless ages it just clung to the edge of the precipice before returning to a safer spot. I was beginning to think I was in for a prolonged wait when were borne to me the tones of children conversing at the foot of my tree. 'Yes,' said one, 'there is nobody up the tree. The *sahib* has not come yet and the *shikari* has gone to the station to meet him. Well do I know these facts—have I not been waiting hard by for over two hours and seen everything? *Chello, gonsla dekinge*'! Thus it came to pass that a couple of minutes later three urchins arrived by my *machan*. I had to act quietly and carefully—I must not frighten them or one or more might be precipitated to the ground below and be killed. I unclipped the side of the *hide*, pushed my head out and *invited* them to look at the nest and its contents and told them in future not to believe everything they were told. Never, I think, have children's eyes 'goggled' as did these infants'; and when last I saw them they were running as hard as their little legs would take them even though two big fields divided us.

This interlude, I imagined, would postpone the owl's return indefinitely. I was wrong. Fifteen minutes later I felt a bird land heavily on a branch behind me; and presently the dusky horned owl flew on to the nest and brooded her two children. Again and again the elder one peeped out from under the parent's body or through her wing or tail feathers, and the photograph shows one of the most delightful family scenes it has been my good fortune to witness.

Always I was struck by the extraordinary resemblance of the owl's head to that of a cat; particularly was this the case when the bird looked over the side of the nest towards passers-by below.

This pair of dusky horned owls preyed chiefly on green parrakeets, as the numerous beaks and feathers below proved. Remains of a common mynah and of a roller were also found, but none of house or jungle crows, on which, in some localities, this species largely subsists. A pair of these owls have lived in this particular spot for a number of years, and many is the time I have watched one of the birds fly into a tree in which countless parrakeets roosted, and carry off a squawking victim. Long may they flourish here!

If there is a 'sameness' in the nesting arrangements of our eagles,

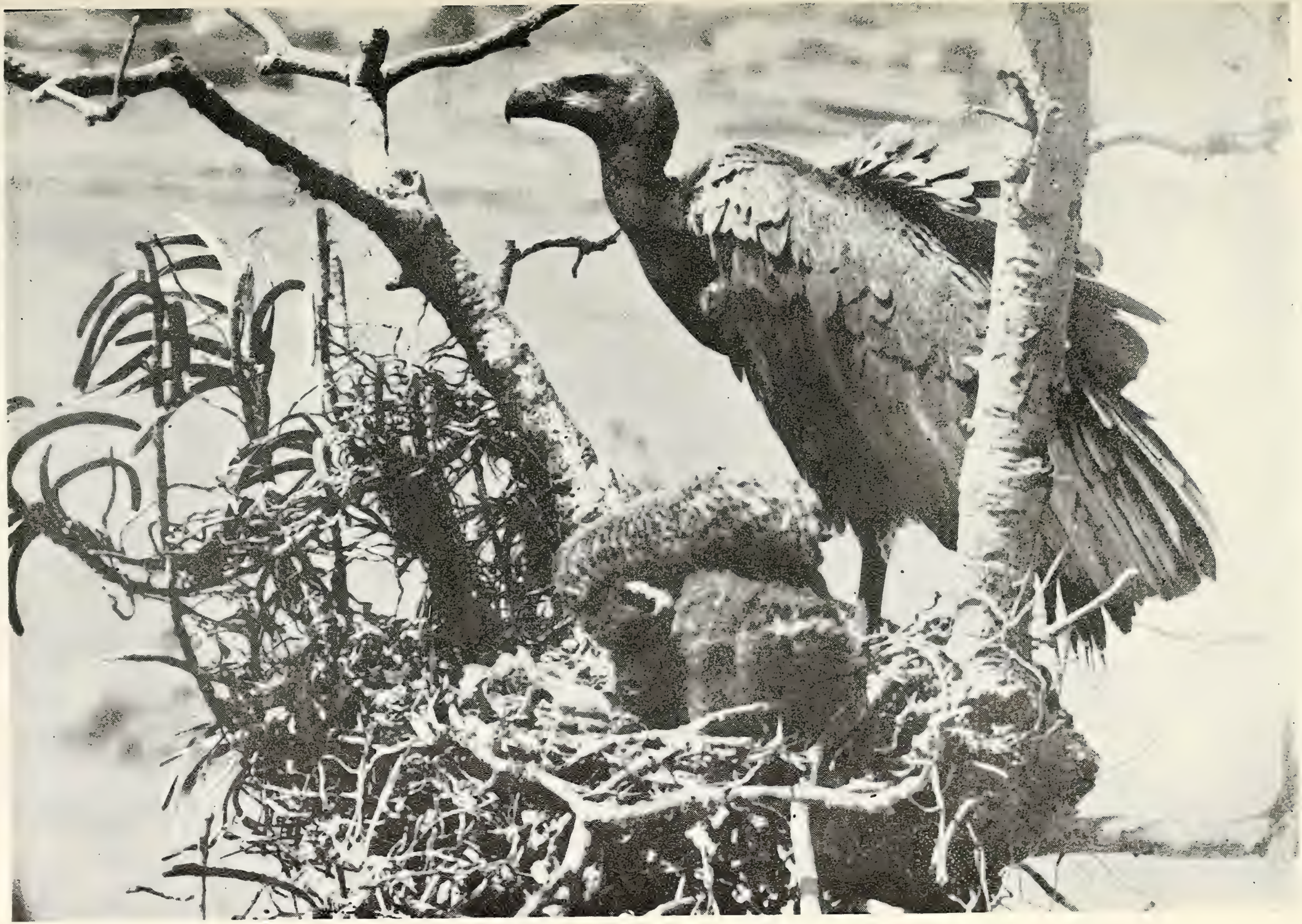


Photo by *Northern Long-billed Vulture.* E. H. N. LOWTHER.

1. *White-backed Vulture.*

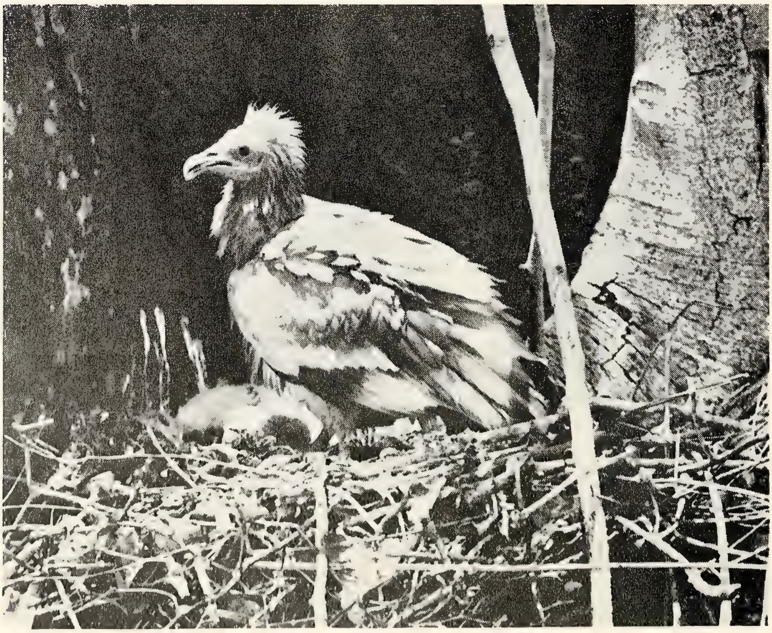


Photo by 2. *Lesser Scavenger Vulture.* E. H. N. LOWHER.

in the time of their nidification and in their habits at the nest, the statement applies with even greater force to the vultures. It is true, of course, that while the white-backed and northern long-billed species have eggs in November and December, the king vulture does not lay till February, and the lesser scavenger vulture delays its nesting till March and even April. It is also correct to say that, while all four species make their nests high up in trees, the scavenger vulture commonly places its ugly and evil-smelling pile of sticks and vermin-infested rags, etc. on a ledge of a cliff, and even on old buildings, and their like—a pair bring up their family every year by the North side rose window of the Allahabad Cathedral; and in the absence of high trees a king vulture sometimes makes its nest on the top of some thorny bush. Taking them all round, however, the vultures vary little in their breeding arrangements, or in their behaviour at the nest, so that there is not a great deal one can say concerning them: which, as a friend remarked, is perhaps just as well. I have not seen the 'change over' take place in the case of the king vulture or the northern long-billed vulture, but both sexes certainly incubate, where the scavenger vulture and the white-backed vulture are concerned. With all four species both sexes help to build the nest, and feed the young. And what a perfectly revolting sight this is! When it is remembered that vultures feed on carrion, which may have been dead for hours, or even a day or so, and that before this can be given to the young it has to be assimilated thoroughly in the parent's crop, a matter which also takes some hours, it is easy to understand what a loathesome spectacle is a young vulture's meal when being served. I am not squeamish, but I must confess the sight has very nearly made me retch. *And the stench*!—the less said the better—it has haunted me all day and night, and my advice to those who would photograph vultures at the nest feeding their young is to wear a gas mask.

There has been a tendency of late to tell the World that the king vulture is not the monarch he is supposed to be; that other vultures at the vile feast do not give place to him; that he is, in fact, a craven. Let me, therefore, record two experiences in his favour. The first occurred at the nest at which my photographs were taken. While I was toiling up the scrub-covered hill side where the nest was situated, the queen was seen to alight at the nest and then disgorge food for the youngster. A common pariah kite then circled round the tree and thought it too would like to partake of the carrion meal. It swooped down at the queen again and again; and as often Her Majesty 'ducked'. But the king, who was quartering the heavenly vaults, seeing what was happening, bore down on the kite—with wings half closed and at terrific speed; and there was no further trouble with the kite *that* day.

In *By Tank and Jhīl* I mentioned that a young grey heron which made no attempt to 'stroke' the parent's bill in order to help it part with the food it had brought, but instead kept its head well down in the nest, and as a result was usually the first to contact the disgorged meal, met with a tragic end. I was in the *hide* at the time, more dead than alive on account of the appalling heat. The young had recently been fed and left to themselves, to gasp in the nest, or wander about just near it. Suddenly there was a great commotion and before one could say Jack Robinson a king vulture darted down and carried off in its feet the unfortunate youngster. I saw the incident plainly in the mirror of the reflex, and my *shikari* and a friend who had accompanied me, witnessed it too. They also saw the vulture finally drop the young heron which, on being retrieved, was found to be dead.

Perhaps these incidents will help to restore the king vulture to his royal status.

A SKETCH OF THE BOTANY AND GEOGRAPHY OF NORTH BURMA.

BY

F. KINGDON-WARD, B.A., F.R.G.S., F.L.S., ETC.

(*Continued from Vol.* xliv. *No.* 4 (1944), p. 574).

PART II

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VI. CLIMAX FORMATIONS.

The following comprise the climax formations of North Burma. The three primary divisions of the vegetation on the basis of vegetative type dominant within their respective limits, are:—

(i) Forest	500–12,000 feet
(ii) Scrub	11,000–13,000 ,,
(iii) Undershrub and Herbaceous	12,000–15,000 ,,

The climax formations in succession are:—

Tropical Evergreen Forest	500– 2,000 feet	Forest.
Subtropical Hill Jungle	1,500– 5,500 ,,	
Subtropical Pine Forest	3,500– 6,500 ,,	
Temperate Rain Forest	5,000– 8,000 ,,	
(*a*) Warm Temperate Rain Forest.	5,000– 7,000 ,,	
(*b*) Cool Temperate Rain Forest	6,000– 8,000 ,,	
(*c*) Temperate Pine Forest	4,500– 8,000 ,,	
Mixed Temperate Forest	7,000– 9,000 ,,	
(*a*) Moss Forest	9,000 — ,,	
(*b*) Bamboo Forest	9,000 — ,,	
Silver Fir Forest	9,000–12,000 ,,	
Sub-Alpine Rhododendron Scrub	11,000–13,000 ,,	Scrub.
Alpine Turf and Scree	12,000–15,000 ,,	Undershrub and Herbaceous.

The alpine herbaceous flora, restricted as is the area it occupies, includes a large number of species, and vast numbers of individual plants, some of which occur in large, others in small colonies, while many others are scattered.

The altitudes given for each zone are not of course exact contours. They represent approximate limits, where a more or less distinct change of climate occurs. The overlap of 1,000 or 1,500 feet allows for local differences, proximity to the plains in the south, or to the snow mountains in the north, and for the effect of north and south slopes.

One of the factors affecting the type of vegetation which prevails is the continuity of sunlight, the distribution of which varies of course with the latitude. The extremes are the equatorial and polar regions; and though both receive the same number of hours sunshine (supposing the sun to be always shining) in a year, its distribution is very different.

North Burma however covers less than 5° of latitude, hence the distribution of sunlight scarcely varies from one end to the other. The difference of altitude of the sun at mid-summer and mid-winter is however considerable. At midsummer the sun even in the north is almost vertical, being more than 85° above the horizon, whereas at mid-winter it is only about 40° above the horizon. In a mountainous country like North Burma this means that north slopes get very little direct sunshine, particularly in winter.

Other factors affecting the vegetation are soil and temperature, especially maxima, minima, temperature range, and temperature gradients.

Most important of all, at least so far as the main types of vegetation are concerned, is humidity, which everywhere in North Burma, and at all seasons, is relatively high. Certain types of forest, e.g. Pine forest, Silver Fir forest, can be recognised at a glance. With broad leafed evergreen forest, this is less easy. However, there are a number of good indicators, such as the figs, Dipterocarps, Terminalias, laurels, oaks, chestnuts and many more, which once known are easily recognised and help to identify the zone. Above 6,000 feet almost any zone can be identified in Spring and Summer by its characteristic species of Rhododendron, and of course the changes from broad leafed forest to Conifer forest, from Conifer forest to scrub and from scrub to alpine herbaceous are obvious to the least observant.

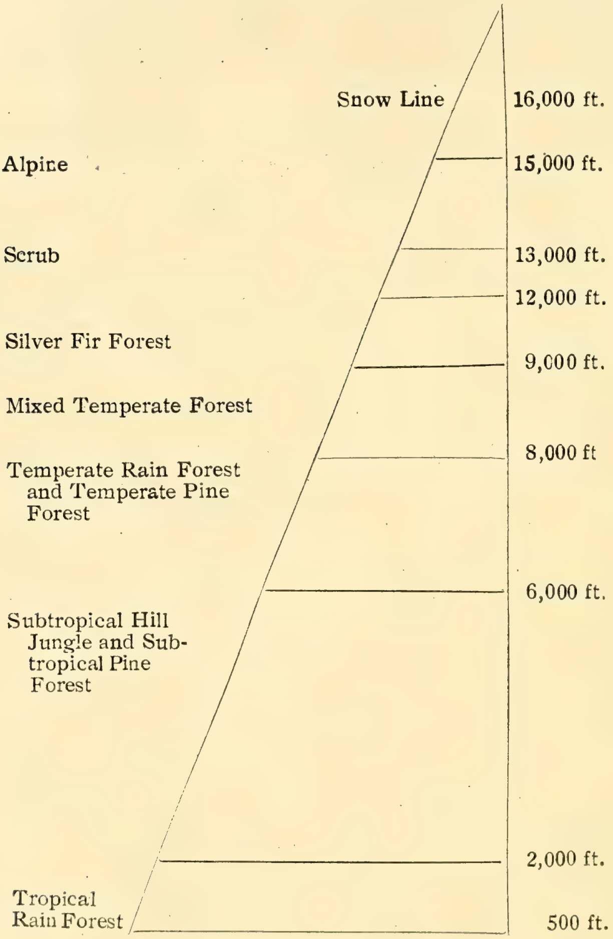
Within each zone are areas where particular species and associations predominate and such are worth noticing.

The following diagram shows the stratification of main vegetation types in the Burmese alps.

Cultivation

Throughout North Burma, except on the Hkamti plain, shifting cultivation is practised, and we have the curious spectacle of a nomadic agricultural population. Few villages appear to last more than 20 years; quite a number scarcely last ten.

Is there any fundamental difference of climate or soil which makes permanent cultivation possible at 6,000 feet, but impossible below that altitude? Or is it simply the tradition of the cultivators? So far as my experience goes, the only permanent cultivation is done by Tibetan immigrants who, in the Seinghku and Adung valleys, have permanent fields at 6,000 feet, just as they would have in Tibet. Owing to the well marked winter at 6,000 feet, fallow land is not overgrown with weeds so rapidly as it is at 2,000 feet. But this has nothing to do with the exhaustion of the soil. The washing out of the humus and soil bacteria on steep slopes as a result of cutting down and burning the forest obviously impoverishes the soil. Much of the permanent cultivated land at 6,000 feet is comparatively level; but shifting cultivation for maize is practised here also. In spite of soil erosion, clearings at 2,000 feet, after the harvest, are quickly covered with weeds. There is nothing to cut and burn. So a new site must be cleared. After the weeds comes bamboo, and after a few years the ground can be cleared and burnt a second time. There is no reason to think that given enough population, permanent


Snow Line
16,000 ft.
Alpine
15,000 ft.
Scrub
13,000 ft.
12,000 ft.
Silver Fir Forest
9,000 ft.
Mixed Temperate Forest
8,000 ft
Temperate Rain Forest and Temperate Pine Forest
6,000 ft.
Subtropical Hill Jungle and Subtropical Pine Forest
2,000 ft.
Tropical Rain Forest
500 ft.

cultivation would be impossible in North Burma. Both wet rice and maize are cultivated on permanent terracing cut out of the steepest slopes in the Naga Hills. Such terracing would be equally possible in the Nam Tamai valley. The problem of clearing, terracing and keeping the exuberant vegetation in check, seems to be mainly one of population. The Tibetan villages are no more populous than the Nung villages; but the Tibetans have a tradition of 'fields', the Nungs have none. Conversely, if more and better food was grown, North Burma could support a larger and more settled population. Now is the time to make forest reserves. Above 7,000 or 8,000 feet there is little danger of forests being destroyed. But it is just in the agricultural belt, between 3,000 and 7,000 feet, that so many interesting trees occur. This zone is rapidly disappearing.

VII. TROPICAL EVERGREEN RAIN FOREST.

Travelling north to Myitkyina by rail from Mandalay, a change comes over the vegetation after Shwebo. We are no longer in the 'dry zone', a sort of dust bowl in the heart of central Burma, but in a damper climate of heavier rainfall, and greater humidity as proved by the evergreen jungle. The railway in fact passes through one of the densest tropical evergreen rain forest districts in Burma. It is this type of forest which north of Myitkyina fills the main valleys, from 500 to 2,000 feet above sea level. Thus the Mali Hka as far north as the Hkamti plain, the 'Nmai Hka up to about 26°50′, the Nam Tisang to about 27°30′, and the lower courses of their principal tributaries, are filled with tropical evergreen rain forest, which also covers much of the Hkamti plain.

At Myitkyina, a well marked hot weather season encourages a more deciduous type of monsoon forest. North of Fort Hertz and all along the China frontier the colder winters produced by abundance of snow on the high mountains have a sobering effect.

In fact tropical rain forest forms only a wide mesh arterial system where the deepest valleys drain the North Burma plateau, representing perhaps 5% or 10% of the whole area.

In composition it is almost pure Indo-Malaysian, most of the genera represented being unknown in cooler climates outside that region. Above 3,000 feet Indo-Malaysian species are found growing side by side with species of East Asiatic affinity, and as we ascend the proportion of the latter increases. Briefly, the North Burma tropical forest is composed of trees from 80 to 120 feet tall, with unbranched straight trunks and umbrella-shaped or rounded-pyramidal crowns. The strangling figs however, which form an appreciable fraction of the forest, are more wide-spreading and are amongst the largest, though not amongst the tallest trees. The bark is usually smooth, sometimes scaly, and of a pale ashy grey colour, looking almost white against the dark background of the forest. It is thin, and cauliflory is not uncommon. The canopy is closed and billowy, laced with lianas. Few trees (e.g. Dipterocarps) rise markedly above the general level. Some of the biggest trees are found in the deep valley of the Nam Tisang and its tributaries, east of the Hkamti plain, where a higher relative humidity is constantly maintained, giving an almost tropical luxuriance to forest which in composition is not specially tropical.

Above 6,000 feet the advantages derived from constant high humidity are outweighed by the disadvantages inseparable from cold winters and a shorter growing season, and the forest takes on a more temperate appearance.

The North Burma tropical forest includes a small proportion of deciduous species, not all of which are bare at the same time, and very few for more than a month (e.g. Spondias). They are conspicuous on account of their comparative scarcity. Most of them shed their leaves in response to cold in December-January, rather than in response to drought in April-May, as in monsoon forest. Remote from the mountains the Myitkyina plain itself, as already remarked, is less evergreen. Some trees (e.g. *Dipterocarpus alatus,* Ficus spp.) heed neither cold nor drought, but shed their leaves in the rainy season, and perhaps at any season.

In the hot weather (March-April) the canopy is of the most varied hue, and the many shades of green, mingled with the bronze, yellow, purple and scarlet (e.g. *Mesua ferrea*) of breaking leaf buds (though the leaves unfold far more rapidly than in temperate climates) make a wonderful display of colour. Shortly before the rains many trees come into flower, while in winter others are conspicuous in fruit (e.g. *Terminalia myriocarpa*, so abundant in the Mali Hka valley).

The casual flowering and leaf renewal of some species is well illustrated by *Stereospermum chelonoides* which I have seen in April both leafless and in full foliage, in flower, and in fruit. Isolated roadside specimens are usually leafless in the hot weather, but those inside the forest are usually at least fledged.

The trees grow close together, no two in contact alike. None are gregarious, though many are extremely abundant. Trees isolated from the surrounding forest generally die, like parts cut from a living organism.

Beneath the billowing canopy there is a lower storey of small trees and large shrubs, scattered amongst the giants, e.g., *Kydia calycina, Wendlandia tinctoria, W. scabra, Sterculia coccinea, Vernonia Alpinii, V. Vidalli, Baccaurea ramiflora, Croton Joufra, Sarcosperma katchinense, Aporosa dioica, Mussaenda Roxburghii, Ordisia floribunda, Callicarpa floribunda, Clerodendron nutans;* with species of Actinodaphne, Myristica, Mallotus, Glochidion, Saurauja and many more.

In marshy ground by the roadside grow colonies of tall Alpinia, and other Zingiberaceae, Araceae (Lasia and others), and grasses. Where the forest has been burnt, bamboos and species of Musa spring up gregariously; these take possession of the roadside, where repeated cutting and burning to keep the road open takes place. Naturally herbaceous plants do not bulk large in this zone, but there are a few characteristic species besides those mentioned above, e.g. *Crotolaria teragona*, whose vivid chrome yellow flowers may often be seen in winter on the edge of the jungle. Roadside banks give herbaceous plants every chance, and here we see species of *Didymocarpus, Chirita* and other Gesneraceae, several species of Begonia (more typical of the next zone), small Acanthaceae as Rungia, Rubiaceae (Oldenlandia), Orchidaceae, and vascular Cryptogams. The beautiful violet flowered saprophyte *Burmannia disticha* is common in ditches on the Hkamti plain. The following are common trees:—*Chisocheton paniculatus, Duabanga sonneratioides, Terminalia Catalpa, Gmelina arborea, Pterospermum acerifolium, Bombax malabaricum, Echinocarpus assamica, Shorea assamica, Dillenia indica, Elaeocarpus obtusus, Castanopsis indica, Talauma Hodgsoni, Quercus semiserrata, Magnolio pterocarpa, Bischofia javanica, Trema orientalis, Salix tetrasperma* (by streams), *Gnetum Gnemon.*

The more bizarre looking trees include screw pine (*Pandanus furcatus* and others, *Caryota urens* (one of the very few tall palms other than climbing species), small palms such as Zalacca, Livistona, Wallichia in the undergrowth, large strangling figs (*Ficus Benjamina, F. elastica*), tall non-epiphytic figs with bunches of fat fruits dangling from their trunks, and tree ferns. Big climbers and epiphytes, though not so many and varied as in the Malaysian jungle, are nevertheless important. Amongst the former may be mentioned a fine pink flowered Chonemorpha, *Beaumontia grandiflora, Bauhinia Pottingeri, B. tenuiflora, Thunbergia grandiflora, Hiptage Madablotta, Porana racemosa, Aspidopterys obcordata, Toxocarpus himalensis,* also many large climbing palms, Acacias, vines, Asclepiads, and others, besides root clinging Ficus and Aroids.

Epiphytes are mostly herbaceous, a few shrubs (e.g. *Fragraea, Aeschynanthus acuminata*), small orchids, ferns (*Platycerium, Cyclophorus*), *Lycopodium.* This epiphytic flora grows more varied, including many shrubs, as one ascends, whereas lianas decrease in size and variety, a hint that humidity favours the former, heat the latter.

It is not difficult to recognise the tropical rain forest. Characteristic trees can be picked out at all seasons, by their shape; or they are conspicuous in flower, or in young foliage, or in fruit. Good indicators are *Mesua ferrea* (scarlet when in young leaf), *Terminalia myriocarpa,* very conspicuous when festooned with bunches of red fruit, the tall Dipterocarps, the strangling figs, the twisted Pandanus, and other outstanding trees.

There is one sere, associated with the two lower forest zones, of which mention must be made, and that is the river bank vegetation between low and high water, exposed during the winter months. It includes herbs, shrubs, and small trees. The crimson flowered *Rhododendron Simsii* grows on rocks in the river beds of both the Mali Hka and 'Nmai Hka less than 1,000 feet above sea level. With it one sometimes sees a white rose like *R. bracteata*, and less commonly *Woodfordia floribunda.* Three distinct associations occur according to whether the ground is mainly sand, pebbles, or solid rock—there are no mud banks on these swift rivers.

Not much will grow in pure sand except along high water mark where, fringing the jungle, a barrage of vegetation beats back the river's roaring tide. These shrubs, whose tangled roots from which the sand is often washed away, giving almost an appearance of mangrove, are often partly submerged, but they form a fine defensive belt to the jungle behind. Here grow a number of interesting plants, such as *Syzygium* (*Eugenia*) *polypetalum*, *S. aciculinum*, *S. Cuttingii*, *Elaeagnus rivularis*, *Camellia stenophylla*, *E. nitida*; several of these endemic.

In crevices of rock grow several ferns (Dryopteris, *Pteris Griffithii*) and small grasses (*Tripogon trifidus*, *Arundinella setosa*, *Apocopis Wightii*) and such plants as *Justicia procumbens*, all these withstanding long submergence. In stony ground clumps of the queer *Cryptocoryne Cruddasiana*, and in sandy places *Strobilanthes arenicolus* are other common intertidal plants. A common under-shrub is *Rhabdia lycioides*.

The close relationship between the equatorial rain forest of Malaysia and the rain forest of North Burma needs no emphasis. Many species are common to both. On the other hand many Malayan species and genera are not found in North Burma. There is no doubt however that the evergreen tropical rain forest forms a continuous belt from Malaysia to North Burma in spite of the 'dry zone'—a local interruption—in central Burma. This belt reaches from 10° or 15° south of the equator to 28° north of the equator a distance of 2,500 miles.

In Pleistocene times the North Burma plateau was covered with an ice sheet which reached as far south as 26° (Htawgaw) on the China frontier and to 27° further west. Glaciers probably crept even further south and their influence must have been felt beyond Myitkyina. In Yunnan there is ample evidence that the ice sheet reached at least to 24°.

So far as North Burma is concerned, this Indo-Malaysian flora must have travelled northwards up the valleys in the wake of the retreating ice. It followed hard on its heels, in quite recent times. Hence the flora of the low country is overwhelmingly Indo-Malaysian. It may be argued that there is no such thing as tropical rain forest in North Burma. We can of course take that view if we prefer it, lumping together everything up to 5,000 feet and calling it subtropical forest. I do not think it is a matter of profound importance. Classification is a convenience, a ready filing system (though it has, or we hope it has, a significance of its own) framed to help, not to hinder us. It reflects the state of our knowledge at the time. As knowledge accumulates the tendency is to distinguish more exactly. My own preference is to call the bottom storey of the North Burma forest, tropical evergreen rain forest, and I have no difficulty in recognising it when I see it. The classification here put forward may serve a useful purpose until, with further knowledge, a better one is framed.

Endemics of the tropical rain forest belt are: *Bauhinia Pottingeri*, *Albizzia Vernayana*, *Camellia stenophylla*, *Elaeagnus rivularis*, *Syzygium Cuttingii*, *S. aciculinum*, *Agapetes Wardii*, *Rauwolfia rivularis*, *Strobilanthes arenicolus*.

VIII. SUBTROPICAL HILL JUNGLE.

There is no sharp dividing line between this zone and the last. Tropical Rain Forest passes insensibly into Subtropical Hill Jungle which above 3,000 feet at any rate is easily recognised by a larger proportion of oaks, chestnuts, laurels, Meliaceae, also by an increase in the number of tree ferns, palms (especially climbing palms) and

Pandanus; and by a marked decrease in the number of strangling figs. Many common trees of the tropical zone ascend to 3,000 or 4,000 feet, but as we approach the high mountains and experience sharper winters, e.g. on the Hkamti plain, tropical species decrease.

It is as the zone of Magnoliaceae and laurels that the subtropical hill jungle is most easily distinguished. In spite of the abundance of other species, laurels, easily recognisable both in flower and in fruit, form an appreciable fraction of the forest. Many no doubt belong exclusively to this zone. What trees are altogether confined to the hill jungle it is at present impossible to say, but the following are at any rate characteristic. *Aesculus assamicus* (absent from or very rare in the Mali valley, common in the Nmai valley), *Carpinus viminea, Ulmus lanceaefolia, Engelhardtia spicata, Lithocarpus spicata* and *L. viridis, Castanopsis argentea, C. argyrophylla* and *C. hystrix, Betula alnoides* and *B. cylindrostachya, Magnolia pterocarpa, Talauma Hodgsoni, Manglietia Caveana, Michelia punduana* and *M. floribunda, Acer pinnatinervium* and *A. chionophyllum, Tetrameles nudiflora, Eriobotrya platyphylla, Bauhinia variegata, Albizzia Vernayana, Illicium cambodianum, Lindera caudata* (with drip-tip leaves, which are of frequent occurrence in this zone). *L. megaphylla, L. dictyophylla* and *L. Neesiana, Litsaea brachypoda.* Mention must also be made of Nephelium (at least one species different from that found in the tropical forest), Parinarium, Spondias, Lagerstroemia, Sterculia, Garcinia, Actinodaphne, Cinnamomum. One or two Dipterocarps ascend to 3,000 feet. Big trees with handsome compound leaves, such as Cedrela, Chisocheton and Melia are frequent.

The decrease in the number of strangling figs has been mentioned; there are also fewer tall figs of the *F. pomifera* type. In the Tamai valley (3,000-4,000 ft.) the commonest tree species are *Ficus Cunia, F. obscura, F. hirta,* and *F. clavata,* besides smaller shrubby and climbing species. Bamboos of several genera occur in variety, mixed with the trees, and there are many climbing palms, which here attain their maximum development. In the hill jungle the tree trunks are more frequently concealed behind a wealth of root climbers—Aroids such as Raphidiophora, Ficus, ferns, mosses, and foliacious lichens, besides epiphytes and lianas. Amongst the last mentioned are *Lonicera Hildebrandi,* several species of Clematis, Vitis, Bauhinia, Mussaenda, Rubus, Celastrus, Toddalia. Other big lianas are *Kadsura heteroclita, Jasminum pericallianthum, J. Duclouxii, Stachyurus cordatula, Gelsemium elegans,* and *Illigera nervosa.* Herbaceous climbers include *Gentiana* (*Crawfurdia*) *Trailliana* and *G. Bulleyana,* species of Codonopsis, Dactylicapnos, Porana.

Epiphytes are more abundant here than in the tropical belt. They include shrubs and herbs—Medinilla, Aeschynanthus and other Gesneraceae, Hedychium, Vaccinium, Schefflera, many orchids and ferns, and Agapetes. In fact North Burma may well be the present centre of distribution of this last genus. Above 4,000 feet, especially in the neighbourhood of high mountains, the first epiphytic Rhododendrons, including *R. dendricola* and *R. taronense* are found.

Coming to the undergrowth, many shrubs grow on the steep slopes and on ridges, in second growth and along the rocky river banks. Mention may be made of the following: *Daphne* *papyracea, Rubus indotibetanus, Viburnum cylindricum, Buddleja asiatica* and *B. candida, Rhododendron sino-Nuttallii* (often epiphytic), *Eurya chinensis* and *E. nitida, Stryrax serrulatus, Symplocos araioura, Brassaiopsis trilobata,* species of Lasianthus, Ficus, Euonymus, Syzygium, Pittosporum; there is also scattered herbaceous undergrowth, ferns and monocotyledons. Yet except along the beds of torrents, the hill jungle is fairly open, not particularly difficult to penetrate, although there are thickets of climbing palm or other impenetrable vegetation in places.

In spite of its generally smaller trees the hill jungle still bears the stamp of the tropics which is more exactly the stamp of a warm moist climate. But there is an obvious difference already in the herbaceous vegetation, well seen in seres such as occupy the roadside banks and river beds. There is an increase in the number of species of Impatiens, Begonia, Chirita, Viola, Strobilanthes, Didymocarpus, also in the families Commelinaceae, Gesneraceae, Campanulaceae, Zingiberaceae. Other common plants on the roadside banks are Campanumoea, Canscora, and Lycopodium. Two notable ground orchids found in this zone are *Paphiopedilum Wardii* and *Cypripedium villosum,* the former endemic, the latter extending southwards at least to Moulmein. It is in fact in the upper strata of the hill jungle that the botanical explorer really begins to enjoy himself.

As to the relationship of the flora it is still largely Indo-Malaysian, but now there is an increasing number of Chinese forms. Above 5,000 feet as the winters grow longer and colder, the Eastern Asiatic element as rapidly increases. Nevertheless within the 5,000 feet limit the climate is not so very different from that of the tropical belt, with a longer cold weather check on growth. There is the same high relative humidity.

So far I have made no attempt to define the limits of the hill jungle except in terms of altitude. The lower limit may be taken roughly as the winter mist line, that is the altitude above which winter mists do not normally lie. On the Hkamti plain for example, the mist, which often persists till 10 A.M., is perhaps a thousand feet thick. Approaching the plain in December in the early morning one looks down onto a sea of cloud; and in this mist bath the tropical forest stands for several hours daily throughout the cold weather. In the Mali valley, between Myitkyina and Fort Hertz, mountains more than a thousand feet above the river are generally clear of mist, which drenches the lower jungle—you can hear it dripping like rain from the trees on which it condenses. The hill jungle is clear of this stagnant humidity.

The upper limit corresponds roughly with the lower limit of *Bucklandia populnea,* which begins somewhere about 5,000 feet.

Endemics of the Subtropical Evergreen Hill Jungle are:—

Acer pinnatinervium and *A. chionophyllum, Saurauja subspinosa, Brassaiopsis trilobata, Maesa Marianae, Symplocos araioura, Strobilanthes stramineus, Ophiorrhiza lignosa, Vernonia adenophylla, Lactuca gracilipetiolata, Illigera nervosa, Eriobotrya platyphylla, Paphiopedilum Wardii, Agapetes adenobotrys, A. pubiflora, Stachyurus cordatula, Wickstroemia floribunda, Brachytome Wardii, Lasianthus Wardii.*

IX. SUBTROPICAL PINE FOREST.

The Ngawchang valley between Htawgaw and Gangfang has been cultivated for at least 200 years and by immigrants from China, the lower slopes are everywhere terraced with permanent rice fields, in contrast with the shifting cultivation practised over the greater part of North Burma. The lower 2,000 or 3,000 feet of the valley up to a height of 6,000-7,000 feet above sea level is occupied by Pine-Oak Forest (mainly confined to exposed south facing slopes). This Pine-Oak Forest, called Subtropical Pine Forest by Champion, forms open parkland, the trees growing amongst grass and bracken, and also scattered shrubs. Not less characteristic in this association is alder. The oaks commonly associated with *Pinus insularis* are *Quercus incana, Q. serrata* and *Q. Griffithii*; shrubs include *Pieris ovalifolia* (which suffers severely from an unsightly blister blight), *Wendlandia speciosa, Vernonia clivorum* and *V. adenophylla* (the latter semi-scandent), *Dipentodon sinicus* (sole representative of the new family Dipentodonaceae Merril), *Gaultheria Griffithiana* and *G. yunnanensis, Litsaea euosma, L. moupinensis* and *L. Forrestii.*

The question arises, is the Subtropical Pine Forest a climax formation or is it a fire pre-climax? Periodically in cold weather the dry hill sides are burnt, and this manifestly favours the growth of Pine. On the other hand, the sandy soil also favours the growth of Pine. In shady gullies it is true one finds normal subtropical evergreen hill jungle sometimes with scattered Pine, as in the Ngawchang valley below Htawgaw. This forest so far as one can judge has never been burnt, and it seems probable that the whole valley would be similarly forested, were it not for the effect of fire, which undoubtedly favours the Pine at the expense of broad-leafed trees.

To whatever it owes its origin, the Pine-Oak forest exists as a definite climax and will continue to exist as long as the hill sides are periodically burnt.

In the less exposed parts, and in ravines, where *Pinus insularis* is not conspicuous, many trees occur, the following amongst them: *Altingia excelsa, Rhodoleia Forrestii, Prunus cerasoides, Ulmus lanceaefolia, Carpinus viminea, Elaeocarpus dubius, Alnus nepalensis, Podocarpus neriifolia, Betula cylindrostachya, Schima argentea, Acer laevigatum,* and more rarely is *Wightia Alpinii, Gordonia axillaris,* and the Chinese palm *Trachycarpus excelsa,* probably introduced from China. Several of these are at least as characteristic of the Subtropical Hill Jungle. *Prunus cerasoides* is as much at home with *Pinus excelsa* as with *P. insularis*; and the same is true of *Prunus Wallichii.* On the other hand *Rhodoleia Forrestii* is only recorded from the China frontier.

Shrubs include *Berberis bicolor* and *B. incrassata, Mahonia lomariifolia, Dendropanax burmanicus, Plagiopetalum Esquirolii, Sporoxeia sciadophylla, Clethra Delavayi, Aucuba humalaica, Helwingia himalaica Corylopsis manipurensis, Microtropis discolor, Luculia intermedia.* Some of these are endemic and several are equally common with *Pinus excelsa* in the Temperate Pine Forest, e.g. Clethra, Corylopsis, and Microtropis. Many small woody climbers, species of Clematis and Smilax, *Sabia Ritchiae*, *Mezoneurum cucullatum*, *Prenanthes volubilis*, occur in the Pine forest.

Epiphytes are fewer and less conspicuous than in the corresponding moister climax, Subtropical Evergreen Hill Jungle. They are chiefly ferns and small orchids, but there are also a few Ericaceae including *Rhododendron dendricola* (which is equally at home on boulders in the open) and *Agapetes Lobbii*, also found on boulders.

Pinus insularis is scarcely found below 3,000 feet in the Ngawchang valley and here it is mixed with broad-leafed forest and with *Podocarpus neriifolia*, the undergrowth consisting largely of the big gregarious fern Dipteris. Not many Pine trees survive above 7,000 feet, where one occasionally meets with *Pinus Armandi*, as near the Panwa Pass. At this altitude the scarlet *Rhododendron Delavayi* is a gorgeous sight in spring. The open grassland of the Panwa Pass with scattered oaks (*Quercus Engleriana* and other species) is very like the Pine-Oak forest of the Ngawchang valley, but 2,000-3,000 feet higher, as indicated by the presence of *Rhododendron Delavayi* which does not grow below 8,000 feet. There are no Pines above Changyinku, a village at about 7,000 feet, below the Pass. When forest reappears beyond the open grassland of the Panwa Pass, it is Mixed Temperate Forest, with several small tree Rhododendrons, such as *R. euchaites* and *R. habrotrichum*, even an occasional silver fir. Subtropical Pine Forest is in fact a local development; the normal sequence is Subtropical Hill Jungle—Temperate Rain Forest. It might almost be regarded as a specialised type of Subtropical Hill Jungle, just as Temperate Pine Forest is a specialised type of Temperate Rain Forest.

Nevertheless the pine forest has a very characteristic herbaceous flora, which hardly occurs in any other part of North Burma, chiefly associated with the bracken clad slopes. Notable are two lilies, *Lilium Bakerianum* and *L. ochraceum* var *burmanicum*, both Chinese, *Aeginetia indica, Gentiana cephalantha, Primula denticulata, Euphorbia cyanophylla, Gerbera piloselloides, Anemone begoniifolia, Inula Cappa, Senecio densiflora, Anisodenia pubescens*. The endemic *Paphiopedilum Wardii* is a Pine forest plant at Htawgaw, but grows in Subtropical Hill Jungle east of Fort Hertz, which is the type locality. All the above plants are increasing with the burning of the grass-bracken hillsides, none faster than the lilies and *Primula denticulata*.

As regards climate, it is like that of the Subtropical Hill Jungle, but since much of the country is open, the winters are colder. There is winter rain and no complete cessation of growth, though it reaches a low ebb for two or three months. Slight ground frosts occur at the upper limit. In March-April several leafless trees flower, others put forth fresh leaves, so that there is a kind of Spring, heralded by the flowering of the cherry trees at the end of February.

X. TEMPERATE RAIN FOREST.

(*a*) *Warm Temperate Rain Forest.*—The next zone may be distinguished as temperate rain forest and is characterised by a fair proportion of deciduous species, a rich epiphytic flora, and a well-marked spring and winter, with occasional frosts and a little snow.

Above 5,000 feet there is a marked falling off in the number of purely tropical species and a corresponding increase in the number of northern and East Asiatic species. Climbing palms, bamboos, tree ferns, and similar curious forms are still numerous, may even reach their optimum in the lower strata of the Warm Temperate Rain forest; but many tropical trees, including the strangling figs, disappear. Small figs remain including scandent species.

Perhaps the most positive feature of this zone is the large epiphytic shrub flora including half a dozen species of Rhododendron (Sections 'Maddeni' and 'Vaccinioides' chiefly), Agapetes, Pentapterygium, Aeschynanthus, Ficus and others. Epiphytic ferns, orchids, Gesneraceae, Zingiberaceae are also abundant. The epiphytic *Begonia hymenophylloides* occurs in one locality where it is not uncommon. There are fewer big lianas, though *Kadsura Roxburghii* and Schisandra are found, also species of Dioscorea. Climbing palms (Calamus and Daemonorops) are locally common up to 6,000 feet, away from the snows, but most of the woody climbers belong to northern genera like Clematis and Lonicera. Others are Smilax, Jasminum, Sabia, Aristolochia and *Holboellia latifolia.* Herbaceous climbers include several Composites, as *Senecio scandens*, *Prenanthes volubilis*, *Mikania scandens* and *Cucubalus bacciferus.* Erect palms are comparatively rare and of small stature; some of the tree Araliaceae bear a superficial resemblance to palms. Pandanus ascends to 6,000 feet.

Tree Rhododendrons appear for the first time at about 6,000 feet and include *R. stenaulum, R. eriogynum* and *R. Kyawi.* A few species of Ilex occur. Characteristic trees include *Quercus lamellosa, Alnus nepalensis*, *Betula cylindrostachya*, *Bucklandia populnea* and notably the big stem-clasping semi-epiphytic *Wightia Alpinii.* The vertical range of Bucklandia marks roughly the lower and upper limits (5,000-7,000 feet) of the Warm Temperate Rain Forest. A goodly number of oaks and laurels (mostly small trees) survive into this zone and several new species appear. The only conifers are pines (which generally occur in sufficient numbers to give distinction to the forest as subtropical or temperate pine forest), Podocarpus and Taxus.

In the more open forest, unencumbered with masses of climbing plants, many shrubs and small trees are found, including species of Sorbus, Euonymus, Viburnum, Eugenia, Photinia, Daphne, Oxyspora, Callicarpa, Ficus, Embelia and the very characteristic *Decaisnea Fargesii*, *Dichroa febrifuga*, *Dobinea vugaris*, *Potingeria accuminata* and also the beautiful *Luculia intermedia*, so conspicuous in bloom in the cold weather. There are also numerous species of Rubus.

Herbaceous flowering plants are more frequently met with in this zone than in the more densely forested regions below. They include not only northern genera like Viola and Anemone, but even northern species in such genera as Ranunculus, Oxalis. Species of Strobilanthes, Begonia, Impatiens, Arisaema are fairly numerous. Other characteristic species are the endemic *Primula dictyophylla* and the widespread *Parochetus communis.* Several Compositae and Umbelliferae are also met with, also *Paris* and *Lobelia.*

As regards climate, winters are longer and cooler, summers shorter and cooler than in the subtropical hill forests. There is a distinct and lovely spring marked by the flowering of cherries, Rhododendrons and many other trees and shrubs. For the first time we experience occasional frosts at night. Deciduous trees are on the increase, notably species of Acer; and from 5,000 feet upwards Indo-Malaysian plants rapidly dwindle, to be replaced by Eastern Asiatic, Sino-Himalayan and northern forms.

It may be remarked that until we reach the neighbourhood of the high frontier ranges, there are few signs of temperate forest below 6,000 or even 7,000 feet, and any attempt to distinguish between warm and cool temperate forest would probably be unsuccessful. But where the mountains are 15,000 feet or more high the distinction is useful.

There are, to borrow a term from the geologists, unconformities of vegetation. But in the Adung valley, and again along the China frontier, wherever big valleys run far back into the alps, a more definite stratification of the vegetation is clearly visible. The following endemics belong mainly to the Warm Temperate Rain Forest:—*Coelogyne ecarinata, Litsaea brachypoda* and *L. Cuttingiana, Sorbus paucinervia, Photinia myriantha, Pygeum cordatum, Peliosanthes longibracteata, Dactylicapnos grandifoliolata, Camellia Wardii, Syzygium stenurum, Gamblea longipes, Begonia hymenophylloides, Dendropanax burmanicus, Rhododendron dendricola, Diplycosia alboglauca* and *D. pauciseta, Primula dictyophylla, Aeschynanthus Wardii, Ixora Kingdon-Wardii, Leycesteria insignis, Viburnum Cuttingianum, Prenanthes volubilis, Aster Helenae, Senecio pentanthus.*

(*b*) *Cool Temperate Rain Forest.*—The sign of cool temperate forest is the appearance of many trees and large shrub Rhododendrons, which for the first time occupy a position of importance in the forest. Some are gregarious to a greater or lesser extent, some are epiphytes. *Rhododendron magnificum, R. panikimense* and *R. decorum* form an impressive group, all of which are found from 6,000 feet up. Between 7,000 and 8,000 feet, *R. bullatum, R. cringerum, R. butyricum* and *R. neriiflorum* appear. The great tide of Rhododendron, which floods the forest between 6,000 and 12,000 feet and submerges the alpine region beyond, has set in.

Deciduous trees form a larger proportion of the forest (which is still mainly broad-leafed) in this zone than at higher levels where Conifers and Rhododendrons predominate. These include maples, cherries, birch, ash, laurels, Schima, Sorbus, Gordonia, Tetracentrum and others, also a remarkable species of Zanthoxylum, resembling a Rowan at first sight. Amongst evergreen trees, species of Ilex begin to increase. An important point about the deciduous trees is that all of them shed their leaves in winter—there is no hot weather with its accompanying drought to disturb them. On the contrary in the warm weather of April and May, the leaf and flower buds of many trees, e.g. cherry, oak, laurels, Ficus, maple are bursting. Most of the Rhododendrons begin to flower rather earlier (February-March) and a vast procession of migratory birds is passing up the Adung valley, some of them lingering amongst the Rhododendrons whose flowers contain both honey and insects. Many of the characteristics of the warm temperate zone, e.g. the large epiphytic shrub flora, are emphasized here. The four seasons of temperate lands are also well established.

The wealth of shrubs associated with the more open type of forest to which attention was called in the warm temperate zone is continued into the higher zone. Now the first of many species of Berberis—*B. incrassata*, makes its appearance. There are many species of Sorbus, Euyra, Agapetes, Lindera, some of them endemic. Other shrubs are *Neillia thyrsiflora*, *Decaisnea Fargesii*, *Rubus chaetocalyx*, *Rhododendron neriiflorum* and *Gaultheria Wardii*. The herbaceous flora includes plants of open places such as *Primula burmanica* as well as forest undergrowth. *Iris Milesii* grows on the cliffs of the Adung gorge. Endemics of the Cool Temperate Rain Forest are numerous and include: *Rhododendron magnificum*, *R. Taggianum*, *R. agapetum*, *R. insculptum*, *Berberis incrassata*, *Lindera Vernayana* and *L. Wardii*, *Sorbus deter-ibilis* and *S. apiciden*, *Eriobotrya Wardii*, *Rubus chaetocalyx* and *R. Wardii* (Merrill non Evans), *Ilex cyrtura* and *I. Wardii*, *Euonymus burmanica*, *Acer chloranthum*, *Eurya Wardii* and *E. urophylla*, *Sporoxeia sciodophylla*, *Agaptes pseudo-Griffithii*, and *A. Vernayana*, *Primula burmanica*. The relationship of the flora is mainly with the Himalayas and with western China and to a lesser degree with the mountainous parts of the Indo-Malayan region.

(*c*) *Temperate Pine Forest.*—*Pinus insularis* as we have seen is found in North Burma, between 3,000 and 6,000 feet, more or less. At 4,000-5,000 feet, where it grows best, it forms forest, mixed with *Quercus spicata* and *Q. Griffithii*, on exposed slopes, but the trees are scattered more as in parkland. Above 6,000 feet it passes; not directly into Mixed Conifer forest of which it is never apparently a constituent as *Pinus excelsa* is, but into Temperate (broad-leafed) Rain forest, below the main Conifer belt.

Pinus insularis is reported not to occur in the 'triangle' except in one or two isolated parts in the south. But since nobody has crossed the high Mali-hka-Nmai-hka divide in the north where it would be most likely to occur, this statement must be accepted with reserve. It is also said not to occur on the Kumaon range, but I doubt the truth of that statement also. We know that a pine, almost certainly *P. excelsa* grows on the Chaukan pass; and it is not unlikely that *P. insularis* grows on the Kumaon range south of the pass. At any rate in the Htawgag and Hpimaw hills *Pinus insularis* is common down to 3,500 feet.

Pinus excelsa on the other hand does not occur below 4,000 feet and is found up to 8,000 feet. Between 5,000 and 7,000 feet it forms open parkland on exposed slopes, just as *P. insularis* does, but associated with different species of trees. Unlike *P. insularis*, however, it also occurs scattered through broad-leafed forest on sheltered slopes, and at 8,000 feet one finds it mixed with Hemlock Spruce (Tsuga) and Picea in Mixed Conifer forest. But fire has never entered the true Temperate Pine Forest, where *P. excelsa* is mixed with broad-leafed trees and thick undergrowth. This however is nothing more than a special development of Cool Temperate Rain forest, as already described. Where *Pinus excelsa* predominates on exposed slopes, it is due to fire; just as with *P. insularis*, the pine seedlings survive the grass fires which destroy many of the other trees. *Pinus excelsa* overtops the broad-leafed trees with which it is associated by 30 or 40 feet on the average, hence from a little distance the forest appears to be pure Pine forest. It probably forms 50% of the forest in many places, e.g. in the Seinghku valley. The broad-leafed trees mixed with it include oaks, Ilex, laurels, Rhododendrons, maples, cherry, together with a thick undergrowth of Arundinaria. There are fewer epiphytes, but woody climbers include *Clematis Forrestii*, *Schizophragma integrifolia*, *Paederia foetida*, *Aristolochia Griffithii.*

There is no need to say more about the Temperate Pine forest, which is easily recognised by the presence of one conspicuous tree; otherwise it conforms closely with the Temperate Rain Forest in all respects.

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. ST. J. MACDONALD.

(*Continued from Vol.* xliv, *No.* 4 (1944), p. 535).

(*With* 15 *text-figures*).

PART VII (*Continued*).

OTHER SPORTING FISH AND HOW TO CATCH THEM.

Goonch (17), Silund (18), Mulley or Freshwater shark (19), Tengra (20), Butchwa (21), Eutropiicthys murius (22), Clupisoma garua (23), Seetul (24), Notopterus notopterus (25), Gar Fish (26), Freshwater Eel (27), Thorny Eel (28), Murrals (29), Goby (30), Megalops (31).

Order: **Siluroidea.** Sheat Fishes

These are the scaleless fish, popularly known as Cat-fishes in virtue of their feelers or long barbels which are arranged around the mouth. Though essentially a fresh water group, some species are also found in salt water, usually keeping, however, near the coast. Some of the members of this family grow to such a huge size that they are generally known as 'Fresh water sharks'. They mostly prefer muddy to clear water, a fact for which their feelers are well suited. The Sheat Fishes are easily distinguished, chiefly by the absence of scales and the presence of barbels or feelers and frequently a second dorsal fin which is known as the adipose fin. The mouth is always furnished with teeth, which, however, varies much in form and disposition. They all take a live bait picketed or a spinning dead bait; sometimes a spoon or phantom. They should all be fished for with wire and treble hooks. They do not give much play and are apt to sulk on the bottom.

Sheat-fish is derived from Schaid-fish, the former German name of *Silurus glanis*, the Wels of the Danube.

Genus: **Bagarius**

Gill openings wide, gill membranes confluent with the skin of the isthmus. Barbels eight, one pair nasal, one pair maxillary and two pairs mandibular. Palate edentulous, teeth in jaws pointed and unequal. Thorax destitute of any adhesive apparatus. Dorsal fin with one spine and six rays, adipose dorsal present. Dorsal, pectoral and caudal fins produced into long filaments.

17. **GOONCH, Bagarius bagarius** (Ham.).

Vernacular name :—*Bagh Ari*, Dinajpur and Rungpur; *Vaghair*, Purnah; *Boonch* or *Goonch*, N.-W. Provinces; *Gorea* or *Bag Machh*, Assam; *Rahti Jeyyah*, Telugu; *Sah-lun*, Ooriah; *Kheerd*, *Moolandah* and *Guwch*, Poona and environs.

D. 1/6/0; A. 12–15; P. 13; V. 6; C. 17.

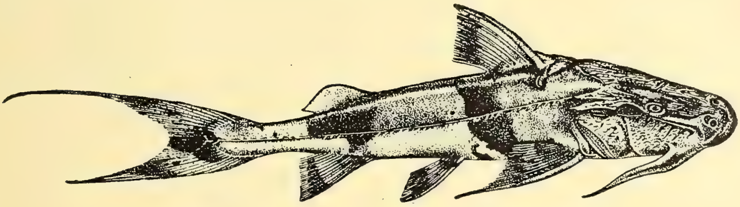


Fig. 17.—*Bagarius bagarius* (Ham.).

Head depressed and naked. Eyes small, situated in the middle of the posterior half of the head. Mouth ventral, considerably behind the tip of the snout. Teeth sharp and unequal in the jaws. An outer widely separated row of larger ones is also present in the mandibles. There are eight barbels, the nasals being smaller than the diameter of the eye, the maxillary barbels possess broad bases and are generally shorter than the head. The dorsal spine is smooth, and the fin has elongated soft termination of varying length. The pectoral spine is stronger, serrated internally and provided with a soft prolongation. The caudal fin is deeply forked and both the lobes are produced into soft filamentous processes. The caudal peduncle is narrow and whip-like. The skin on the body is scabrous. This is multicoloured fish, yellow, black, brown and blue. The colouration, however, will also depend on the type of water inhabited by a particular specimen. This fish grows to a size of six feet or more and to a weight of over 250 pounds.

These monsters are as ugly as they are unpopular, and are taken in the same water as the mahseer. They have a most remarkable power of adhesion, and when hooked can hold on to the bottom of the river whether it be sand or rock, and in the strongest of currents. They will waste hours of your time if in any numbers, and owing to sulking take twice as long to kill as a mahseer. Coarse eating and looking, and should be classed as the vermin of the water. Not found in tanks.

Genus : **Silonia**

Body elongated and compressed. Head moderate and rounded anteriorly. Eyes lateral, behind the angle of mouth and visible both from above and below, and provided with circular adipose lids. Mouth anterior, wide and obliquely directed upwards. Lower jaw somewhat longer and broadly pointed in the middle. Teeth in the jaws large and caniniform, projecting outside. A continuous V-shaped band of villiform teeth across the palate. Post-labial groove widely interrupted in the middle. Nostrils wide apart and slit-like. Two small maxillary barbels in grooves and hence liable to be overlooked. Dorsal provided with moderately developed bony spine which is roughened externally and serrated internally. A small adipose fin present. Pectoral spine also is strong and serrated internally. Gill membranes deeply notched united with each other but free from isthmus.

18. **SILUND, Silonia silondia** (Ham.).

Vernacular names :—*Silun* (Bengal for young and half grown). *Dhain*, Bengal for larger specimens; *Silondia-Vacha*, Calcutta; *Silon*, Dinajpur and Rungpur; *Baikar*, Gorakhpore; *Silond*, Punjab; *Ji-lung* and *Silond*, Ooriah and Beng.; *Wanjou*, Telugu.

D. 1/7/0; P. 1/11–13; V. 6; A. 4/36–44; C. 17.

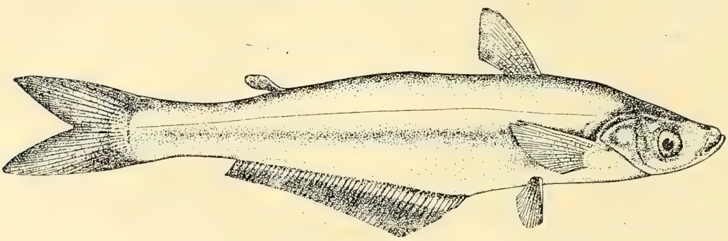


Fig. 18.—*Silonia silondia* (Hamilton).

In its younger stages this fish is herring-shaped, but with age its belly becomes very bulky with the result that in full-grown specimens the ventral profile is greatly arched.

Colouration.—According to Hamilton 'The back is of a dusky green'. The silund is the fresh water shark, and comes first in this group from the sporting point of view. They attain a length of 6 feet, and a weight up to 100 pounds. They have two small barbels, dorsal pectoral fins thorned. Anal fin rays 36-44. Caudal large and strong. Mouth, armed with rows of sharp formidable teeth, is large and square. The general appearance is that of a large Butchwa. They feed in shoals much the same way as Butchwa, and can be located by the heavy splash-splash when they are feeding. They are fished for the same way as the mahseer, only dead bait is more killing than spoon. They frequent the fast waters in the lower reaches of the rivers, swirls, behind piers and bridges, or where the water is broken. They can also be taken in still deep pools by trolling a dead bait slowly, or with live bait on the bottom. They are found in all the large rivers of N. India and Burma. Do not let its old scientific name *Gangetica* mislead you into believing that they are only to be had in this river system. The two fish in the photograph elsewhere in this book, were caught at Namti in N. Burma.

They go off with a rush the same as Mahseer, and will jump 4 or 5 feet out of the water when hooked. Excellent sport can be had with these fish at the head of a pool, when a river comes down in flood, generally at the beginning of the monsoon. A large bait, 6 inches long, is the best size and the most attractive. It is a worthy substitute for the Mahseer, if one is stationed in the plains away from the haunts of *Babus tor*. Use only wire traces when fishing for the species. It is not a tank fish.

Genus : **Wallagonia**

Among the Siluridae, *Wallagonia* is characterized by the possession of a short dorsal fin of about five rays, by the deeply forked caudal fin which is free from the anal fin, by the free orbital margins to the eyes and by the position of the eyes above the level of the corners of the mouth.

19. MULLEY OR FRESH WATER SHARK. Wallagonia attu (Bloch. and Sch.).

Vernacular names :—*Boyali*, Bengal ; *Boal* or *Pangash*, Ooriya ; *Wah-lah*, *Vale* or *Vallah*, Tamil ; *Gwali* or *Mullee*, Hind. ; *Bawqli*, Assam ; *Mul-la* and *Pi-i-hee* and *Jer-i-hee*, Sind ; *Poikee*, Gond. Paren.

D. 5; P. 1/13-16; V. 8-10 ; A. 4/82-89; C. 17.

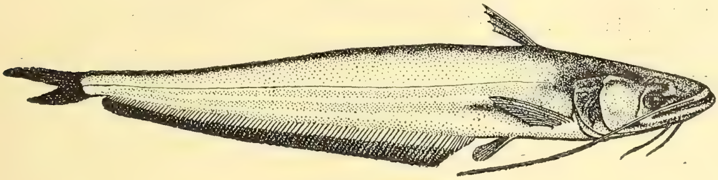


Fig. 19.—*Wallagonia attu* (Bloch).

This is the mulley or the so-called fresh water shark. It is devoid of scales and is provided with long feelers. It is not eaten by the higher classes on account of its forbidding aspect and unclean feeding habits. It is a greatly elongated fish. The huge mouth is armed with two broad bands of large sharp teeth. The fish is a monster growing to 6 feet in length. The head is the most conspicuous part of the fish. The eyes are small, situated entirely above the mouth opening. The snout is spatulate and the lower jaw slightly the longer. The maxillary barbels extend to the anterior part of the anal fin, while the mandibulars are as long as the snout. Broad bands of depressible pointed teeth are found on the jaws ; those of the posterior rows increasing in size. The vomerine teeth are similar and are situated in two oval patches. The lateral line is well marked. Colour uniform grey.

It is queer in shape, with an enormous head and mouth running down to a point, and in small tail. The head must weigh more than half of the total weight. The anal fin runs down almost the whole length of the body. Is blue in colour. His mouth, like the Silund's, is well armed with sharp rows of teeth, takes all forms of bait. Is not a very good fighter, is highly predacious, and fancied as a table fish.

Found in tanks and rivers, and are best taken in the evening when they feed along the edges in shallows, on frogs, and small fish. I have seen these fish taken in Bihar in a curious way, in the many large lakes. The fishermen use a stout cord, about 5 feet long, tied to a strong bamboo, 7 feet long. A large hook is mounted to the end of the cord on which as many earthworms as possible are attached. A boat is then quietly moved along the edge of the lake, and when a suitable spot is arrived at, the top of the rod is briskly worked backwards and forwards in the water, to disturb the surface. It is then allowed to rest for a while and the performance repeated, with the usual interval between; if no fish is taken, the boat is moved on and the same procedure followed. I have seen four and five large fish taken in this way in a morning. The fish is apparently attracted by the vibrations set up, and when he arrives finds a hook full of worms awaiting him. Do not stock them in tanks, or they will devour everything except themselves.

Mr. Dunsford gives a very interesting account in 'The Anglers' Hand Book', on how to catch this fish in tanks with fly rod, which I reproduce here, for those readers who would like to give it a trial.

> 'A good deal can be done with a spoon or phantom in a tank full of Mallis. I have had some really excellent sport in this way. My first attempt was in a muddy tank under the Fattehabad Bungalow in the Hissar District, where I took 125 fish, all Mallis in three days, with spoon and phantom.'
>
> 'This was in the month of June some eight years ago. On my next visit in the following February, I took about 15 fish in three days, on spoon only, but they ran much bigger, and the thinning out had evidently allowed them to grow. The average weight on the first occasion was about 2 lbs. and the biggest fish 6 lbs, while on the second occasion the average weight was 3 lbs and the biggest 10 lbs. I have no doubt that if I had remained in the Hissar district, till the hot weather, I should have made a good bag of decent sized fish in this tank.'
>
> 'I have off and on done a good deal in this way, but the cream of this sport as far as my own personal experience goes, was obtained on the 31st May and 1st June 1888, just a fortnight before writing these notes, when I tried a couple of tanks at Kharkhoda, in the Rotak district.'
>
> 'On the 3rd May I killed 32 "Mulleys" weighing 115 lbs, of which 11 weighing 40 lbs were taken on live bait, and 21 weighing 75 lbs, on a 1½ inch spoon (silver). The biggest fish on this day weighed 12 lbs.
>
> 'After this they got to know something about the spoon, and more so as, owing to blunt hooks, several fish were severely pricked and got off. On the 1st June I killed 10 fish, weighing 37 lbs, and on 2nd June 11 fish, weighing 33½ lbs. Total bag for three days 53 "Mulleys" weighing 185½ lbs, average weight exactly 3½ lbs.'

There are, besides, many other ways of catching this fish. Frog on the surface or on the bottom, dead or live bait, meat or even *atta*, if it is highly flavoured.

Any tank that takes in flood water, during the monsoon, or pools in the beds of rivers, etc., will almost certainly hold these fish in large numbers.

Genus : **Mystus**

20. **TENGRA. Mystus seenghala** (Sykes).

Vernacular name :—*Teng-ga-ra*, Punj.

$$\text{D. } 1/7\text{; P. } 1/9\text{; V. } 6\text{; A. } 11\text{-}12\left(\frac{3}{8\text{-}9}\right)\text{; C. } 19\text{-}21.$$

The fish attains a big size. The greatest width of its head equals ½ to 4/9 of its length. The upper surface of the head is granulated in ridges and its median longitudinal groove reaches the base of the occipital process. The snout is spatulate and the upper jaw is the longer. There are four pairs of barbels. The maxillary extends to the middle or just beyond the hind margin of the dorsal fin, the nasal to opposite the middle of the orbit, the external mandibular to the base of the pectoral fin and the internal is one-third shorter. Teeth are present on the palate in an uninterrupted crescentic band. The spine of the dorsal fin is weak and indistinctly serrated posteriorly. It is as long as the head excluding the snout. The spine of the pectoral fin is stronger, roughened externally, denticulated internally and is half as long as the head. Ventral fin arises behind the vertical from the last dorsal ray. The caudal fin is deeply forked, upper lobe being the longer. There is a large, pear-shaped air-bladder which is not enclosed in bone. *Colouration.*—The fish is brownish along the back and silvery on the sides and beneath with a round black spot at the posterior end of the base of the adipose dorsal fin. It is quite a game fish and taken chiefly on baits of the ranker nature; entrails, bad meat, dead fish, and near burning ghats, though he may occasionally be had on spinning baits. It is fancied as a table fish. Day gives—'The Indus, salt-ranges of the Punjab, Jumna and Ganges certainly as low as Delhi, also the Deccan, Kistna river to its termination, and Assam.'

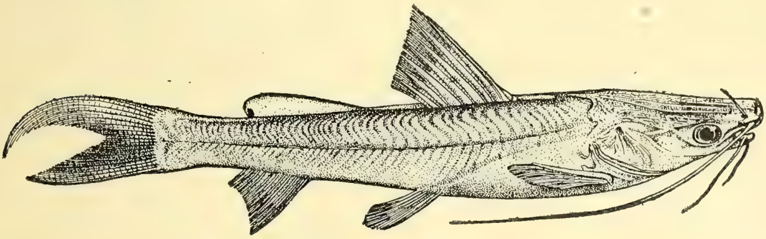


Fig. 20.—*Mystus seenghala* (Sykes)

Genus : **Eutropiichthys**

21. BUTCHWA. Eutropiichthys vacha (Ham.)

Vernacular names :—*Butchwa*, Hind. ; *Vacha*, Beng. ; *Butchwa* and *Nandi butchwa*, Ooriya; *Bikree*, Oudh, Punj. ; *nee-much*, N.-W.F.P. ; *Chel-lee*, Sind ; *Nakhellettee*, Tamil; *Nga-myen-kouham* and *Katha-baung*, Burmese.

D. 1/7/0; P. 1/13-16; V. 6; A. 3-4/42-47; C. 17.

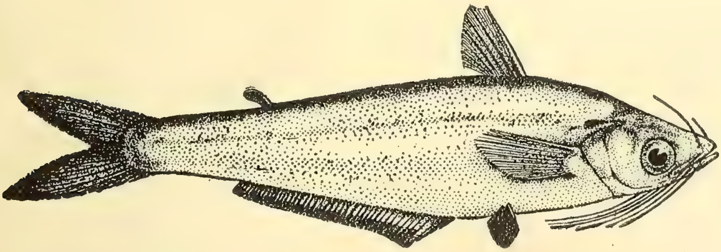


Fig. 21.—*Eutropiichthys vacha* (Hamilton).

The true Butchwa *E. vacha*, that is the game little fellow that takes a fly, fly spoon or any spinning bait and that hunts in shoals, has been confused by Thomas, Lacy and Skene Dhu in past works, with *Clupisoma garua*. In order to elucidate this, a short description and figures of the three common fish (all called Butchwa) will be of assistance. *E. vacha* (Ham.) (fig. 21) is the true form and the best known to anglers, taking fly and fly spoon readily, and if well on the feed disturb the surface of the water with the familiar splash-splash while taking toll of the small fish. They are usually found feeding near bridges, in runs, and in the swirls near masonry structure and at junctions.

It is easily distinguishable, with 4 pairs of barbels, and a well defined mouth extending back as far as the eye, with the dorsal and pelvic fins practically opposite, and the small adipose dorsal fin which is always present. The body is deeper and more stream lined than either *Clupisoma garua* (fig. 23) or *E. murius* (fig. 22). It is found both in the plains and far up the large rivers well into the hills. I have caught them up to 5½ pounds in weight.

22. **Eutropiichthys murius** (Ham.).

D. 1/7/0 ; P. 1/11 (1/10 Day); V. 6 ; A. 3/35-40 ; C. 17.

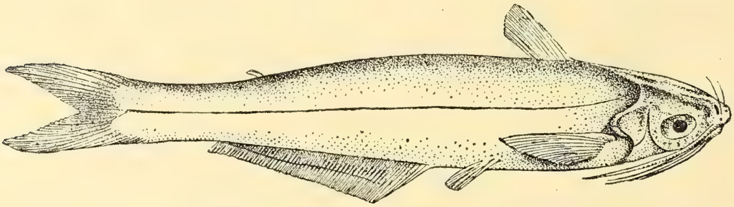


Fig. 22.—*Eutropiichthys murius* (Hamilton).

E. murius (Ham.) is in form much the same as *C. garua*. The main differences being, the head is smaller with the 4 pairs of barbels only extending as far as the head. The lips are fleshy as compared to the other two forms. Feeds on the bottom chiefly, and is taken at the mouth of sewage drains or under *Ficus* trees if the fruit is ripe and falling into the river. Will accept any rank bait.

23. **Clupisoma garua** (Ham.).

The back is not so arched as in *E. vacha*, the mouth is smaller with one of the 4 pairs of barbels (maxillar) extending to the pelvic fin. The dorsal is well in advance of the pelvic fin and there is no

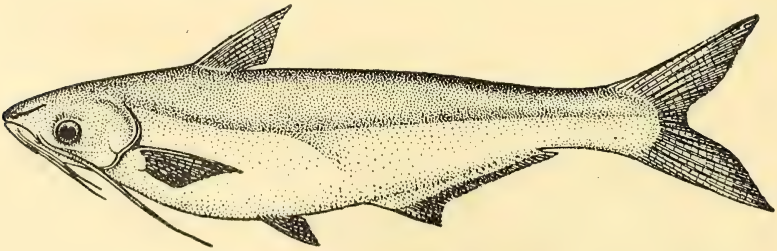


Fig. 23.—*Clupisoma garua* (Ham.).

adipose dorsal fin. This fish is seldom taken on fly or fly spoon, but while fishing well below the surface with worm and other rank bait.

E. murius and *C. garua* do not grow to more than 2 pounds, and are mostly found in the rivers in the plains, they do not appear to move high up the rivers as is the case with *E. vacha*. The fish vendor will sell them all as Butchwa, and though good table fish, because of their filthy feeding habits *C. garua* is to be avoided.

These fish are taken with light tackle used on the small mahseer and *B. bola*. They feed in shoals, and the water literally boils over when they are really on the feed, and small fish suffer complete deletion. Big bags can be made at times. They take best in the rains, and a good bait is the mole-cricket. I have taken 17 of these fish, in less than an hour, at the confluence of the Mali and N'Mai Khas, north Myitkyina, where they run large. Here again I see Skene Dhu put the limit as 5 lbs, my best as I have said before was 5½ pounds, and a dozen fish worked out at an average of 3 pounds so that he seems to run larger in Burma. They are found in all stages in the course of the river, from the sluggish water of the plains to the rocks and rapids of the hills. They live in tanks but are destructive.

Family: NOTOPTERIDAE.

Genus : **Notopterus**

24. **SEETUL, Notopterus chitala** (Ham).

Vernacular names :—*Chitala*, Beng. ; *Chitu*, Oriya ; *Sital*, Assam ; *Gandan*, Sind ; *Mohie*, Bihari ; *Nesh* or *Mohi*, Punj. ; *Bunnih*, Tirhut.

D. 9–10 ; V. 5–6 ; A. 110–125 ; C. 10.

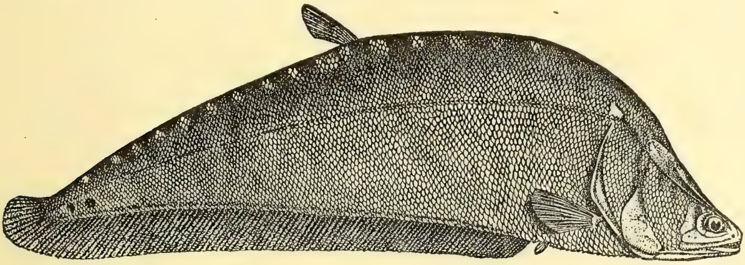


Fig. 24.—*Notophterus chitala* (Hamilton).

The fish is laterally compressed and in shape is more or less similar to *N. notopterus* but the back is more strongly humped in front and the ventral profile is almost straight. The upper profile of the head is deeply concave. The snout is rather prominent and the maxilla extends beyond the hind margin of the orbit. The preorbital is entire. Villiform teeth are present in both jaws, with an external enlarged row, most developed in the centre of the jaw. There are villiform teeth on the vomer and palate. The ventral fins are very minute and the anal and caudal are confluent. The scales are cycloid, extending over the body, opercles and some of the fins : those on the head are not much larger than those on the body. There are about 51 serrations along the abdominal edge between the throat and the insertion of the ventral fin. Colour, silver dark along the back, with about 15 transverse silvery bars on each side of the dorsal ridge, some meeting the corresponding marks on the other side of the ridge. There are about 7 or 8 black spots near the end of the tail. Dorsal fin is yellowish grey white, the other fins are almost white, washed with silver on the basal half. This fish grows to about 4 feet in length.

The Seetul. Thomas in 'The Rod in India' writes:—

> 'Previously knowing them only by book and report, I first saw them for myself at the Narora anicut. The water was alive with them, rolling over on the surface, displaying their bright silvery sides; they are very flat-sided as well as silvery, and "giving one the impression that they were surface feeders. On that hypothesis therefore I fished for them, and fished in vain. But there were some seven other rods there beside your humble servant, rods to whom the Seetul was no stranger, and one of them catching one I asked to see it. The formation of the mouth made me mistrust the surface antics as play, not feeding, and conclude that feeding would ordinarily be at the bottom. The size also of the mouth told its own tale. The mouth was remarkably small for so large a fish, indicating that the natural food must be small. And the dentition was not formidable, the teeth being viliform or file-like. I took a look also at the tackle with which my brother angler had caught the fish. But instead of exactly copying it, I had an idea I could manufacture something more to the fancy of my new customer.'

Although Thomas had success while the small fish were running, this by no means is the normal condition under which this fish is found. In most large tanks, one sees them turning lazily over at intervals of a few minutes, and in very local areas; so much does he appear to rise in one place, that the Indian fishermen tribes firmly believe that they live on mud, and dig holes in the tank over which they constantly rise. They will take bait on the bottom, and near the surface. I have caught them by both methods, and on both red worms, dead shrimps, and prawns; but they will also take a small live bait.

I will give here an interesting incident I witnessed in a railway water tank, which was about 30 yds. wide and 100 yds. long, and full of *Seetul,* or *Mohie* as it was locally called. A grey haired Muhammedan gentleman was catching these fish in a novel way. He baited his hook with dead shrimps, and had his float fixed about two feet above the bait. Just below the float was attached some cotton thread, which was wrapped on a kite flying bamboo reel, known in the vernacular as 'Latai'. His little boy was then sent across the other side of the tank, paying out thread from the 'Latai', and with this thread the child manipulated the bait over where a fish was seen to be rising. I saw the old gentleman take four fish in this way, and lose two. One fought like a tiger and weighed 18 lbs.

As soon as the fish was struck, the cotton thread was pulled away by a sharp tug, which released the knot on the line. This old gentleman taught me what I know of circumventing this fish; and it was he who told me that he had caught them on red worm and small fish, but his choice was for prawns and shrimps.

I have taken them with worm lowered down to the bottom when seen rising close to the bank, and by the method described above, but it must not be imagined that you have only to follow out these methods to catch them. Often will a fish rise 6 or 7 times right up against your float and not look at the bait; if this happens then move on to the next rise and try another fish, and so on.

The mouth of the fish is large enough to take a large bait, and some persevering anglers may take them spinning, though I must confess I have never given the time to further study this fish. I have taken 7 fish in an afternoon, by the thread line method. They fight hard for a bit. They are useless for the table, being very bony and tasteless.

25. **Notopterus notopterus** (Pallas).

Vernacular names :—*Moh*, *But* and *Purri*, Punj.; *Moh*, N.-W.P.; *Pholœ*, Beng.; *Ambutan-Wallah* or *Babersknife* and *Chotta Wahla*, Tam.; *Wallah-tattah*, Mysore; *Pulli* or '*a slice*', Ooriah; *Kan-doo-lee*, Assam; *Nga-hpeh* and *Nga-phe*, Burmese.

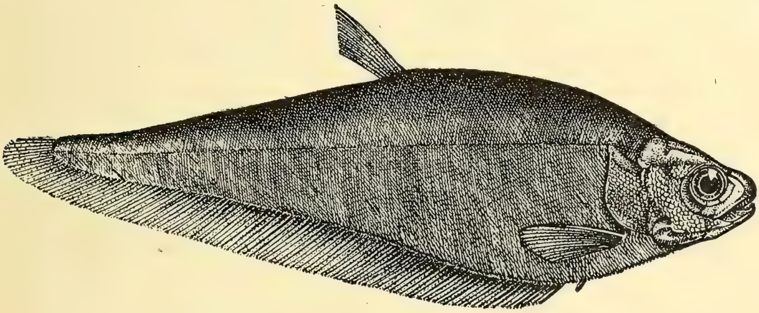


Fig. 25.—*Notopterus notopterus* (Pallas).

Family: SCOMBRESOCIADAE.

Genus: **Xenentodon**

26. **GARFISH. Xenentodon cancila** (Ham.).

Vernacular names :—Hindi, *Unt*; Punj., *Kanga*; Mahratti, *Katra*; Ooriya, *Gongiturni*; Burmese *Nga-Phon-yo*; Tamil *Pissu-Kolah*; Assam *Kokola*.

$$\text{D. } 15\text{–}18\left(\frac{2\text{–}3}{13\text{–}15}\right);\ \text{P. } 11;\ \text{V. } 6;\ \text{A. } 16\text{–}18\left(\frac{2\text{–}3}{14\text{–}16}\right);\ \text{C. } 15.$$

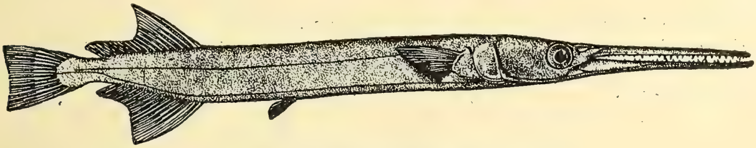


Fig. 26.—*Xenentodon cancila* (Ham.).

This fish inhabits fresh water of Sind, India, Ceylon and also Burma, and it attains at least 12 inches in length.

There is a deep longitudinal groove along the upper surface of the head and the lower jaw is the longer. There is a row of large, sharp, widely separated teeth in both jaws with an external row of numerous fine ones, there being none on the vomer. The dorsal fin commences opposite the anal fin. It is about twice as far from the anterior extremity of the orbit as it is from the posterior extremity of the tail. The ventral fins are inserted rather nearer the base of the caudal than the hind edge of the eye. The caudal fin is slightly emarginate. The scales are small and are arranged in irregular rows on the body. *Colour.*—It is greenish-grey above, becoming white along the abdomen. There is a silver streak with a dark margin extending along the body from opposite the orbit to the base of the caudal fin. The upper two-thirds of the body is closely marked with fine black spots while there are from 4 to 5 layer blotches along the sides between the pectoral and anal fins though there may not be present in the juvenile ones. The dorsal and caudal fins are posteriorly tipped darker. The anal is whitish with a greyish margin. The eyes are golden.

Family: MURAENIDAE.

27. **EEL. Anguilla bengalensis** Gray.

Vernacular names:—Hindi *Kalan*; Mahratti *Ahir*; Tamil *Velangu*; Beng. *Bammachh*; Telegu *Dondupaum*; Chittagong *Balais*; Arracan *Ngami-toung*; Burmese *Nga-shin*; Andaman *Jitada*.

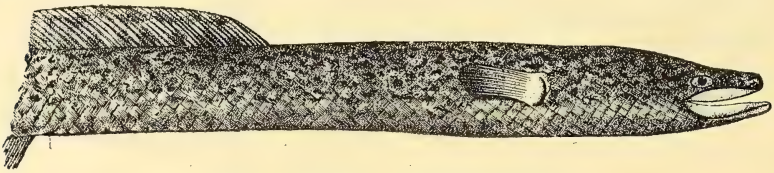


Fig. 27.—*Anguilla bengalensis* Gray.

A true eel attaining very great length, it is distributed in the islands in the Indian Ocean, Continent of India and Burma, being quite common at the Andamans. It is a snake-like fish and an irritable creature, swelling its head whenever angered. The head is broader than the body with a prominent lower jaw. The length of the cleft of mouth equals about 1/3 of that of the head and it extends behind the posterior margin of the orbit. The lips are well developed. The mandibular teeth are divided by a longitudinal groove while the vomerine band does not extend posteriorly so far as the maxillary one. The dorsal fin arises at a point, slightly more than the head length from the gill opening. The distance between the origin of the dorsal and anal fins is equal to the length of the head. *Colour.*—The fish is brownish above, becoming yellowish on the sides and beneath. Sometimes, the upper surface of the body is covered with black spots and blotches some of which may be continued on to the dorsal fin. The anal fin has a dark marginal band and a light outer edge.

Order: **Acanthoptergii**

Family: RYNCOBDELLIDAE. Thorny Eels.

Genus: **Mastacembelus**

28. **THORNY EEL. Mastacembelus armatus** (Lacépède).

Vernacular names:—*Bahm*, *Vahm*, and *Gro age*, Punj. and Sind; Kul-aral and *Sha-ta-rah*, Tam.; *Mudi-bom-mi-day* or '*Old Rhyncho-bdella*', Tel.; *Bahm*, *Bummmi* and *Gonti*, Ooriah and Beng.; *Nga-naway-doh-nga* Burm.; 'Thorny-backed Eel'.

D. 32-39/74-90; P. 23; A. 3/75-88.

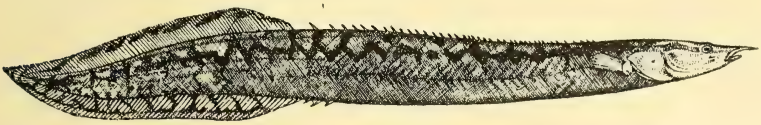


Fig. 28.—*Mastacembelus armatus* (Lacépède).

This is the spiny eel and is considered as nice eating. It is distributed throughout the fresh and brackish waters of the plains and hills of India, Ceylon and Burma to China. It attains two feet or more in length. The width of the body is 2/3 of its height in the young while in the adult it equals the height. The snout is trilobed at its anterior extremity. The maxilla reaches to below the front margin of the orbit. There is a preorbital spine and the angle of the preopercle possesses two or three strong denticulations. The dorsal spines commence over the middle of the pectoral fin. The vertical fins are confluent. There are about thirty rows of scales between the lateral line and the base of the first dorsal ray. *Colour.*—The fish is rich brown above, becoming lighter on the abdomen. A blackish band is sometimes met with through the eye and continued back in an undulating course along the upper half of the side. Above the band, a row of black spots are sometimes seen along the base of the soft dorsal fin. The pectoral fins are usually spotted while the dorsal and anal fins have bands or spots.

Family: OPHICEPHALIDAE.

Genus: **Ophicephalus**

The group of Murrals (*Ophicephalus*) are popularly known as Snake-headed fishes. In virtue of their accessory respiratory organ they can live in any kind of foul water. The body is subcylindrical, tapering from the flattened snake-like head to the rounded caudal fin. Large and irregularly shaped scales are present on the head. Lower jaw is longer: the maxilla reaching below the hind edge of the eye or sometimes even behind it. The teeth of the inner row of the lower jaw are conical while those of the palates are cordiform. The dorsal fin is continuous, arising above the pectoral which does not quite reach the anal. The head and body are covered with scales. There are about 18 to 20 rows of scales between the snout and the origin of the dorsal fin: nine rows between the eye and the angle of the preopercle. The number of rows between the lateral line and the dorsal fin is subject to variation. The fish is dark greyish above becoming dirty white beneath, cheeks and lower surface of the mouth streaked and spotted with grey; bands of grey or black are seen from the sides to the abdomen. It is able to survive out of water for a considerable time. Excellent table fish, and one of the favourites with the natives. It might be claimed that in any tank or stream where weeds prevail, this fish will be found; even though the tank dries up they still survive, aestivating through this period. They can be seen at the surface of the water basking in the sun in the middle of the day, when they can be shot, though this is not sporting.

Parental care.—The Murral exhibits a keen parental affection towards the young, and can be seen working along the edge with a cloud of black youngsters over it. It furiously attacks any fish which comes near, and can be taken by a bait with ease though it is a shame to do so.

Beware of stocking tanks with this fish, where there are other varieties. They have no principles, and will even eat their young after they have attained a reasonable size.

Tackle.—Light tackle or stout gut, or fine wire for preference, as the teeth soon fray the gut; fished for in the manner for Pike, though he can be taken by better means if the opportunity comes your way.

In the C.P. and Berar, I have taken the fish in the two following ways :—

These fish abound in great numbers in the large tanks or lakes built as rain water reservoirs. There is generally a fringe of weeds running along the edge of the tank to about 8 to 10 feet. These fish can be seen on occasions, in the evening, feeding in shoals along the outside fringe of weeds. They move in one direction, and are located by a continual bob, bob, of black snake-like heads on the surface. A light rod and cast, with a fair sized hook run through a mole cricket, and cast into the shoal gives excellent sport, and 5 and 6 fish can be taken in this way out of a shoal, by following them up.

It is great fun and I have seen 11 fish taken in one evening. The fish run to 7 and 9 pounds each. I was indebted to an Uncle for this tip. The other method also tried out in the C.P. is baiting in the clearing of the weeds on the edge of the tank, where Chilwa collect. A live bait is fixed lightly through the back and lowered to a depth of three feet below the surface. The Chilwa are collected, and the Murral is signalled by a thousand small fish jumping out all round the float, like a fire-work display. The next moment the float goes and you have your fish.

Ophicephalus amphibius. McClell.

Ophicephalus amphibius, McClelland, Cal. Jour. Nat. His., V, p. 275. Plates 1 and 6.

Note.—McClelland's *O. amphibius* is united with *O. barca* by Day under the latter name. The species here described does not agree with Day's description of *O. barca* but seems to agree, except in colour, with the scanty notes of McClelland's *O. amphibius* given in Day's 'Fishes of India'. Dr. Hora is inclined to agree with Day in uniting the two species but, seeing that our specimens are all from the type locality of McClelland's *O. amphibius* and local names and habits agree, while the colours agree better with *O. amphibius* than with *O. barca* as described by Day, we have ventured to use McClelland's name.

Vernacular names :—*Bora Cheng*, Mechi; *Borna*, Rabha.

D. 51; P. 17 ; V. 1/5; A. 34; C. 14 ; L. I. 78. Barbels 2-retractile.

In shape almost identical with *O. marulius.* A pair of short, retractile, rostral barbels which are absent in the latter species. *Colour.*—A gorgeously coloured fish. The ground-colour is blue when viewed obliquely and iridescent green when viewed at right angles to the surface. On the body this colour is sprinkled with dark spots, uniform in size but irregular in shape. These spots are absent from the belly, sparse below the lateral line and increasingly plentiful towards the back where they coalesce. On the head the spots are larger and rounded, rich brown below the level of the eye and becoming darker and more plentiful towards the top of the head where they coalesce. The brightest blue (green) and richest brown are in the region of the upper lip. Along the body 13-16 more or less irregular vertical bands about equal in width to the interspaces between them and extending from the dorsal to below to lateral line. These are bright orange bordered with brown and merging into brown on the back and are free from dark spots. The dorsal has the basal half brown or orange, the outer half blue (green), darkening outwards but having a narrow pale blue or white edge. Pectoral deep orange. Pelvics blue. Anal iridescent blue (green) with a narrow dark border. Caudal brown at the base, then iridescent blue (green) with dark rays, then blackish with a narrow white or bluish-white border. *Size.*—Our longest was 18.4 inches. *Habitat.*—Russell obtained his specimens in the vicinity of the Chel River about 1845 and gave them to McClelland. Our specimens all come from this vicinity but Dent, who obtained these specimens, has subsequently received reports from Rabhas living immediately east of the Torsa which indicate that the species is found there also. *Habits.*—The young are found, during the rains, in flooded paddy-fields enclosed by forest. The villagers catch them and put them in their wells to grow. Large fish are found in water-pockets in the beds of dried-up streams in the forest. Russell records that they are found in holes as much as two miles from the river.

Ophicephalus gachua (Ham.).

Vernacular names :—*Cheng*, Bengali ; *Hill*, Nepalese ; *Naserainiselo*, Mechi ; *Na-ram*, Rabha ; *Chaingo*, Hindi (Bihar).

D. 32-37; P. 15 ; A. 21-23 ; C. 12 ; L. I. 40-45.

Shape similar to that of *O. marulius*, but head scales larger. *Colour.*—Brown with a series of about eight darker brown bands sloping slightly forward from the vertical between the dorsal ridge and lateral line, sometimes produced below the latter. Pectoral fin with three lighter zones alternating with darker. Day gives—'In the young there is often a large ocellus with a light edge on the last five dorsal rays'. We have never found this present. *Size.*—We have had them up to about 8 inches. Day gives—'grows to at least 13 inches'. *Habitat.*—Muddy or clear streams and ponds from 2,000 feet downwards. Day gives—'Fresh waters throughout India, Ceylon, Burma and the Andamans, also near Gwadar on the Mekran Coast.'

Ophicephalus punctatus Bloch.

Vernacular names :—*Taki*, Bengali (local) ; *Lata* (Lower Bengali) ; *Na-taki*, Rabha.

D. 29-32; P. 17; A. 21-23; C. 12. L. I. 37-40.

Shape very similar to that of *O. marulius*. *Colour.*—Brown on the back fading to lighter beneath. A series of about eight vertical darker bands above the lateral line alternating with a similar series below it. The last band before the caudal is continuous above and below the lateral line. Pectorals not spotted or striated. *Size.*—We have had them up to 7 inches long. Day gives—'up to a foot'. *Habitat.*—Streams in the hills up to 2,000 feet, muddy streams and tanks in the Terai and Duars. Day gives—'Fresh waters generally in the plains of India, stagnant preferred to running.' *Habits.*—Day, quoting Gunther in Ceylon, records that a female was taken in February containing 4,700 larger, besides some smaller, ova.

Ophicephalus stewartii Flayfair.

Vernacular names :—*Dudu-cheng*, or *Te-cheng*, Bengali; *Na-ram*, Rabha.

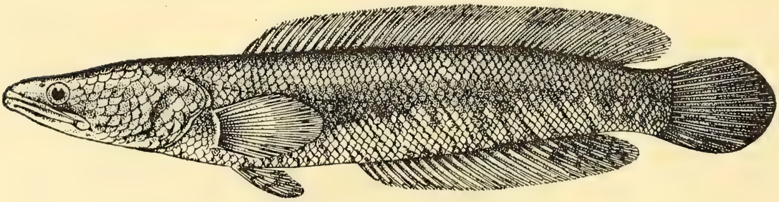
D. 39-40 ; P. 17; V. 6; A. 27 ; C. 14. L. l. 45-50.

Shape similar to *O. marulius*, but the scales on the head are much larger. *Colour.*—Dark brown on the back fading to lighter on sides and belly. A series of about eight indistinct darker bands sloping forwards are generally visible above the lateral line and for a short distance below it. Some scales have a well-defined, circular, black spot. These spots are more plentiful above the lateral line where they roughly follow the darker bands. Below the lateral line they are fewer and more regularly arranged. The dorsal has a deep blue iridescence along its base, during life, and is white or white and orange along its outer edge. The chin is marbled and the pectorals spotted in zones. *Size.*—We have found them up to 18 inches. Day gives—'growing to about 10 inches. *Habitat.*—Clear streams in the forests of the Duars. Day gives—'Cachar and Assam, in both running and standing water'.

29. **MURRAL. Ophicephalus striatus** Bloch.

Vernacular names :—Hindi *Moral*, *Sowl* ; Punj. *Sowl*; Beng. *Sol*; Ooriah. *Sola* ; Mahrati *Sohr*; Canarese. *Marl*; Tamil *Viral* ; Tel. *Sowara* ; Malabar, *Wrahl*; Assam. *Hal* ; Chittagong. *Holi* ; Coorg. *Owlu minu* ; Singalese *Lulla* ; Burmese *Nga-yan* ; Mugh. *Nga-ain*.

D. 37-45 ; P. 17; V. 6; A. 23-26 ; C. 13 ; L. l·50-57.



29.—*Ophiocephalus striatus* Bloch.

In shape this fish resembles *O. marulius*. *Colour.*—Very dark brown above the lateral line, this colour continuing below this line in irregularly-shaped streaks, roughly parallel and a little off the vertical (the upper end in advance of the lower). The rest of the lower half yellow or orange. The pectoral not spotted or striated. The young are orange-red, when 2 or 3 inches long. *Size.*—Our longest just over 2 feet. Day gives—'three feet or more'. *Habitat.*—Muddy rivers and tanks in the Terai and Duars. Day gives— 'Fresh waters throughout the plains of India, Ceylon, Burma, China and the Philippines, especially delighting in swamps and grassy tanks'. *Habits.*—Dent says—'The young, 2 or 3 inches long, are orange-red in colour. On a flooded paddy-field, where the water is 2-3 feet deep, I have seen a mass of probably one or two hundred swimming all herded together like tadpoles. Although I have not actually seen the parent fish myself, all the local busti-wallahs assure me that the mother is always close by and will protect the young from danger.' Day says—'These fishes take a bait very readily, especially a frog, and are said to rise to a salmon-fly'.

Family : GOBIIDAE.

Genus: **Glossogobius**

30. GOBY. Glossogobius giuris. (Ham.).

Vernacular names :—*Wartee-poolah*, *Boan* and *Kurudan*, Mal. ; *Nullatan*, *Oolloway*, Tam. ; *Tsikideondoa* and *Issakee doondoo*, Tel. ; *Gulah*, Ooriah ; *Nga-sha-boh*, Burmese ; *Poo-dah*, Andam. *Ab-bro-ny*, Canarese; *Goo-loo-wak* and *Boul-la*, Punj. ; *Gooloo*, Sind and N.-W.P.

$$\text{D. } 6\ \frac{1}{8\text{-}9}\text{; P. } 20\text{; V. } 1/5\text{; A. } \frac{1}{8\text{-}9}\text{; C. } 17\text{; L. } 1{\cdot}30\text{-}34.$$

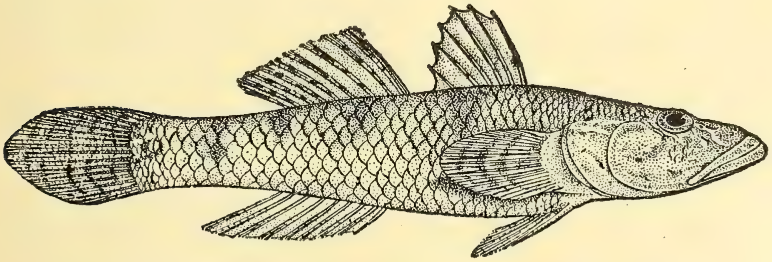


Fig. 30.—*Glossogobius giuris* (Ham.).

This is a widely distributed fish and is found along the east coast of Africa, throughout the plains of India, Ceylon and Burma and Malay Archipelago and beyond. It attains a foot and a half in length. The head is longer than it is broad with a longer lower jaw, its maxilla extending below the anterior margin of the orbit. In the upper jaw the teeth are arranged in villiform rows with an outer enlarged row anteriorly which laterally becomes two rows of which the inner one is sometimes the larger. In the lower jaw also there is an anterior row which becomes double laterally. There are two dorsal fins, the first with a few spiny rays and the rest are all soft rays. The caudal fin is long and may be either pointed or rounded. *Colour.*—The colour of the fish varies with the environment, but broadly it is of a fawn-colour with irregular bands, spots or blotches on the back and sides of the body. The vertical fins are spotted.

SPORTING FISHES FOUND IN BRACKISH SALT WATER.

31. **Megalops cyprinoides** (Brouss).

Vernacular names :—*Punnikown* and *Naharn*, Ooriah; *Moran cundai*, Tamil; *Nga-tan-yonet*, Burmese.

$$\text{D. } 19\text{-}21 \left(\frac{2}{17\text{-}19}\right);\ \text{P. } 15\text{-}16;\ \text{V. } 10;\ \text{A. } 24\text{-}27 \left(\frac{2}{22\text{-}25}\right)$$

$$\text{C. } 19;\ \text{L. } 1{\cdot}37\text{-}42.$$

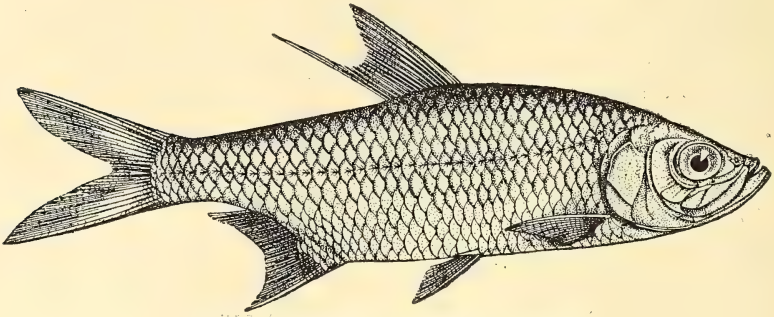


Fig. 31.—*Megalops cyprinoides* (Brouss).

This fish attains a very big size and is found along the east coast of Africa, in fresh waters and estuaries of India, Ceylon, Malay Archipelago, China and Polynesia. The eyes are big and provided with narrow adipose lids. The lower jaw is prominent and the maxilla reaches to opposite the hind edge of the eye. There are villiform teeth in both jaws, on the vomer, palatines and pterygoids. The dorsal fin arises opposite the ventral and about mid-way between the snout and base of the caudal fin. The caudal fin is deeply lobed. *Colour*.—The summit of the head is dark olive while the back is bluish green. The abdomen is silvery with bluish reflections. The sides of the head, the lateral line and the margins of scales are of a brilliant silver. The dorsal and caudal fins are greyish with minute black dots. The margins as well as the last elongated dorsal ray are also black. Pectoral, ventral and anal are diaphanous with some black dots and the last anal ray is dark. The eyes are silvery with a dark tint along the orbital margins.

Cock Up.	*Lates calcarifer.*	These will be discussed in the chapter on Sea Fishing.
Red Perch.	*Lutianus roseus.*	
Bahmin.	*Polynemus tetradactylus.*	
Seer.	*Cybium.*	

English Trout

Family : SALMONIDAE.

Salmo fario, Brown Trout.

Salmo iridens, Rainbow Trout.

Trout Fishing.—This needs but brief mention here, as the few places where the trout has been introduced are either protected by clubs or by Government, and full and detailed information can be had by application to the Secretary of such clubs, or through the Game Warden, or such other official in charge.

Kulu.—Has excellent trout fishing, and some good fishermen have retired there who could be approached for information and help. The Fishing Club would put one in touch with one of these gentlemen or furnish full details of the water, hotels, etc. One angler wrote me and suggested taking a tent.

Kashmir.—Is too well known to make detailed notes here, and all the information required can be obtained from the Game Warden of the State, or from the many residents, some of whom are excellently informed of the best places and lures.

Ootacamund.—There is a useful little book written by Red Palmer, dealing with the fishing near and around Ooty, and the Nilgiris. It is titled 'With Fly, Spoon, and Minnow and Rifle' and acquaints the stranger with the best places, bait etc.

Kumaon.—The Trout hatcheries at Bhowali have been turned into a bathing pool, but the Guna Lake in Garhwal, high up and right off the beaten track, abounds with Trout; stocked years ago from this hatchery they have multiplied to such an extent that one angler on a recent visit there got tired of catching them, they however, run small.

Ceylon.—Further afield is Ceylon, with excellent trout streams. This concludes my knowledge of the Trout fishing obtained in this country.

Brown Trout has in recent years been introduced in Bhutan, where they are doing well. They have also been stocked in certain parts of the Darjeeling Himalayas.

THE BUTTERFLIES OF THE NILGIRIS.

BY

M. A. WYNTER-BLYTH, M.A. (Cantab.).

(*Continued from Vol.* xliv, *No.* 4 (1944), p. 549).

PART II

LYCÆNIDÆ.

148. (H8·α) Spalgis epius epius, Wd.

Found at low elevations but is not common. Three specimens from Kallar, 23/11, 31/12 and 7/5.

Hampson notes that it is more common on the southern slopes than on the northern; 2,000′ to 4,000′.

149. (H10·α) Talicada nyseus nyseus, Guer.

A very local butterfly that is abundant at a number of places between 3,500′ and 8,000′ from February to May, in August and September, and in December.

150. (H11·1α) Castalius rosimon rosimon, F.

Always abundant up to about 4,000′.

151. (H11·2β) **Castalius caleta decidia**, Hew.

Found up to 8,000′, but is never abundant. It can be caught on the plateaux in April and May and at low elevations in April, July and August and December.

152. (H11·3α) **Castalius ethion ethion**, Db.

Common at times at Kallar but it does not extend far up the ghat. I have caught it during most months of the year.
All *Castalius* settle freely on damp sand and mud.

153. (H12·1) **Tarucus ananda**, De N.

'5,000′; northern slopes, September,' Hampson. I have not caught this insect.

154. (H12·α) **Tarucus nara**, Koll.

Found at low elevations only. Rare at Kallar but common at the foot of the northern slopes. Kallar: 20-6-'41 and 28-3-'42. Abundant at the foot of the Sigur Ghat in December.

155. (H13·) **Syntarucus plinius**, F.

Common throughout the Nilgiris. Recorded from Ketti in February and from June to August; from Dodabetta in December and from Kallar from January to August.

156. (H14·1) **Azanus ubaldus**, Cr.

'Rather rare, 1,000′ to 7,000′,' Hampson. However I have found it frequently in April and May from 1,350′ to 8,000′ in the Southern Nilgiris.

157. (H14·3) **Azanus jesous gamra**, Led.

'1,000′ to 3,000′; rare,' Hampson.
Abundant at Kallar in November, '41, settling on damp sand at the ford. I have not seen it on any other occasion.

158. (H17·) **Neopithecops zalmora**, But.

Quite common at low elevations throughout the year.

159. (H18·4α) **Everes parrhasius parrhasius**, F.

'Foot of the hills to the summit,' Yates (Coorg). Here I have not observed it above 3,500′. Keeps to open grassy places and may be caught during most months of the year.

160. (H20·α) **Megisba malaya thwaitesi**, M.

'2,000′ to 4,000′,' Hampson. I have one specimen from the Nadgani Ghat, 2,000′, 8-2-'43. This was caught settling on cowdung.

161. (H21·2β) **Lycænopsis puspa gisca**, Fruh.

162. (H21·3) **Lycænopsis lilacea**, Hamp.

163. (H21·10) **Lycænopsis albidisca**, M.

164. (H21·14) **Lycænopsis akasa mavisa**, Fruh.

165. (H21·19β) **Lycænopsis lavendularis limbata**, M.

Puspa gisca, as in Northern India, extends well up into the hills but is commoner at low elevations. I have seen it in small numbers on wet sand at the ford at Kallar in November, December and March. I have also caught it at Ketti in March and it is not uncommon on the Nadgani Ghat in December and February. *Lilacea* is a low elevation species and is distinctly uncommon. I have caught a number of males settling on damp sand at the ford at Kallar but have not yet seen the female. Season: June and August.

Lavendularis, *albidisca* and *akasa* are only taken, in the Southern Nilgiris, above 4,500′. On the western slopes *akasa* descends to 2,000′ where it is very common in December, January and February. *Lavendularis* is quite abundant on the upper Mettupalaiyam Ghat where the other two are scarce. All are common on the plateaux and the hills, especially at the edges of sholas where they can be found during most of the year in suitable weather.

166. (H23·α) **Chilades laius laius**, Cr.

Abundant all the year round at low elevations.

167. (H24·1α) **Zizeeria trochilus putii**, Koll.

168. (H24·3α) **Zizeeria maha ossa**, Swin.

169. (H24·4) **Zizeeria lysimon**, Hub.

170. (H24·5) **Zizeeria gaika**, Trimen.

171. (H24·6α) **Zizeeria otis decreta** But.

Maha is always abundant on the plateaux but uncommon at low elevations. The underside of the W.S.F. differs but little from that of the W.S.F., a striking contrast to the Northern Indian form.

Gaika is always common at low elevations but scarce on the lower plateau. *Lysimon*, *trochilus*, and *otis* are all found to quite 7,000′, but are only abundant locally.

Lysimon I have seen from August to January and in March: *trochilus* in January, October and November: *otis* from January to April and in November. Given suitable localities all will probably be found throughout the year.

172. (H25·1) **Euchrysops cnejus**, F.

Less common here than in most parts of India. It may be caught up to 6,500′ throughout the year.

173. (H25·2β) **Euchrysops contracta contracta**, But.

Low elevations only as far as I know. I have seen it in small numbers at Kallar from March to May: common there in July.

174. (H25·3β) **Euchrysops pandava pandava**, Hors.

Abundant at Kallar in May and July and also appears in August and September but is much less common then.

175. (H26·2α) **Lycaenesthes lycaenina lycaenina**, Hew.

Not rare at Kallar but uncommon on the lower plateau. Abundant on the Nadgani Ghat in December. In the Southern Nilgiris it appears from March to July and in November: on the plateaux in September and October.

I have a wet season female caught at Ketti, 6,500′, in which the area between the discal bands and the marginal markings on the hindwings is filled in with white.

'Rare' (!) Evans.

176. (H27·1) **Catachrysops strabo**, F.

This usually common insect is uncommon in the Southern Nilgiris. I have caught it in small numbers at Kallar in February, March and April. I have not seen it elsewhere.

177. (H28·) **Lampides boeticus**, L.

Ubiquitous. The foodstuff at Ketti seems to be Atylosia candollei, W. and A.

178. (H29·1α) **Jamides bochus bochus**, Cr.

Not rare up to 7,000′. It is caught on the lower plateau in May and during most of the year at low elevations. It is particularly abundant in the Runneymede neighbourhood just before the S.W. monsoon breaks.

179. (H29·4β) **Jamides celeno celeno**, Cr.

180. (H29·9β) **Jamides alecto eurysaces,** Fruh.

Celeno is abundant throughout the year up to about 7,500′: *alecto* is found with it but is much less common.

181. (32·2♂) **Nacaduba hermus nabo,** Fruh.

Not rare below Coonoor in June and from August to October. It can nearly always be caught settling on damp patches on the road early in the morning at mile 14/8 on the Mettupalaiyam road at these seasons. The female is rare. I have also caught the male on the Nadgani Ghat in February.

182. v. ***sidoma,*** Fruh.

I have a specimen in my collection marked 'Dodabetta, October'. This was from the collection of the late O. C. Ollenbach.

183. (H32·7♂) **Nacaduba helicon viola,** M.

Very rare. I have caught one male which was settling on damp mud at the ford at Kallar, 31-7-'41. Hampson notes, '3,000′ to 4,000′; April . . . May.'

184. (H32·8β) **Nacaduba kurava canaraica,** Tox.

Not rare in the evergreen region. I have observed it in the Southern Nilgiris in June, August and October; on the western slopes in October, December and February, and on the lower plateau in April.

185. (H32·9β) **Nacaduba beroe gythion,** Fruh.

Not rare. Specimens from Kallar in January, February and July, and from the Runneymede neighbourhood in June, August and October.

186. (H32·15♂) **Nacaduba nora nora,** Fd.

Very common at most times of the year below 5,000′. Rare above that altitude.

187. (H32·16♂) **Nacaduba dubiosa indica,** Evans.

Common at about 3,500′ on the southern slopes.

188. (H32·18β) **Nacaduba noreia hampsoni,** De N.

'Male; fairly common: female; unknown,' Hampson. Very rare in Coorg (Yates). Was Hampson confusing this species with *nora?* I have not seen it.

189. (H32·19) **Nacaduba dana dana,** De N.

Not common. I have one specimen from Ketti, 6,500′, taken in April, and three from Kallar in May and December.

190. (H44·1) **Curetis thetis,** Drury.

Hampson states that both orange and white females appear but I have only seen the white female. He also notes that the outer margin of the H.W. is much rounded. He regarded it as very scarce, appearing only on the S. and W. slopes. The female is not rare at Kallar but the male seems to be very scarce. Kallar: March, and July to September. December on the western slopes.

191. (H44·4) **Curetis bulis,** Db. and Hew.

192. (H44·6) **Curetis acuta dentata,** M.

I have published a note elsewhere on the occurrence of these species. *Acuta* is rare but I have seen males on 31/1, 28/3, 16/7, 7/12 and in May (all in '41) at the ford at Kallar. My only female is a specimen from the collection of the late O. C. Ollenbach. This is marked 'Ootacamund.' I myself have not seen this species anywhere except at the foot of the ghats and I should be very surprised to come across it at the altitude of Ootacamund.

I have one definite specimen of *bulis* caught at Kallar on 6-12-41 and one probable specimen from the same place taken on 10-5-42. Evans does not mention *bulis* as a Southern Indian species.

All my specimens of *bulis* and *acuta* from Kallar are small and rounded . . . very different from other specimens in my collection.

It seems to me possible that the Kallar specimens of *bulis* and *acuta* are either distinct races of these species or, a remote possibility, a new species with the characteristic on the under hindwing a very variable one (i.e. the alignment or not of the discal band with the bar at the end of the cell). However, sufficient data are lacking to support this view.

As is usually the case with the *Curetis* genus the marking on the upperside are very variable and of little use for purpose of identification.

193. (H45·β) **Iraota timoleon arsaces,** Fruh.

'1,000′ to 3,000′,' Hampson. I have not seen it.

194. (H46·1β) **Horsfieldia anita dina,** Hors.

'Southern slopes, fairly common: rare on the northern. 2,000′ to 4,000′,' Hampson. I have not seen it.

195. (H49·33) **Amblypodia canaraica,** M.

'Rare; northern slopes,' Hampson. I have not seen it.

196. (H49·36α) **Amblypodia centaurus pirama,** M.

Recorded by Hampson from the Nilgiris.

197. (H49·39α) **Amblypodia amantes amantes,** M.

This species may be seen occasionally at Burliyar, 2,500′, and Kallar, 1,350′, in the Southern Nilgiris. I observed, but failed to catch it, on 28-3-'42 and 20-10-'42 at Kallar, and caught a male there on 31-12-'42. I have also seen a number from Burliyar in a local collection.

This species has a habit of settling for a moment on wet mud and then flying rapidly off. Consequently it is difficult to catch.

198. (H49·71β) **Amblypodia abseus indicus,** Riley.

At Kallar on 28-3-'41 I spotted a small *Amblypodia* on a leaf close to me; I had a good view of the underside and am convinced that it was *abseus indicus*. Although it was an easy catch I failed to take it. The only previous record of this species from Southern India is one specimen from Coorg.

199. (H50·1β) **Surendra quercetorum biplegiata,** But.

Quite common at Kallar but it does not seem to extend up the hills. I have caught it in the Southern Nilgiris in July, from February to April, and from September to December. In July the female may be caught settling gregariously on young bamboo shoots.

200. (H50·4α) **Surendra todara todara,** M.

Recorded by Hampson as common from 2,000′ to 4,000′. This was probably with reference to the Western Nilgiris. I have not seen it myself either in the Southern Nilgiris nor elsewhere in the district.

201. (H53·β) **Loxura atymnus surya,** Cr.

This species is quite common up to 2,500′ in the Southern Nilgiris. It seems to appear throughout the year except in the dry months between February and May.

202. (H57·1β) **Spindasis vulcanus vulcanus,** F.

On the lower plateau it is locally very common except during November and December.

Rather scarce at low elevations in the Southern Nilgiris.

203. (H57·2) **Spindasis schistacea, M.**

The prevalent Spindasis at Kallar, where, however, it is not common. It does not seem to ascend any distance into the hills. I have caught it in February, July, October and November.

204. (H57·4) **Spindasis abnormis, M.**

'6,000′; one male and one female at Coonoor are the only known examples of this insect,' Hampson. It has been recorded since by Hannyngton in Coorg. Whether there are any more recent records from the Nilgiris than that of 1888 I do not know.

205. (H57·7β) **Spindasis elima elima, M.**

'Common; 2,000′ to 4,000′,' Hampson.

Certainly very rare in the Southern Nilgiris. I have one male caught at Kallar on 2-9-'42.

206. (H57·13α) **Spindasis lohita lazularia, M.**

'Rare; 3,000′ to 4,000′,' Hampson. Common in Coorg.

This species does not seem to appear in the Southern Nilgiris. I have one specimen caught on the Nadgani Ghat on 23-10-'42 at 2,000′.

207. (H58) **Zesius chrysomallus, Hub.**

'2,000′; one female,' Hampson.

'One female . . . Coorg,' Yates.

I found a forewing of a male at the ford at Kallar in May 1941. This insect is apparently very rare in the hills of Southern India though it is common round Bangalore.

208. (H59·4α) **Pratapa blanka sudica, Evans.**

I caught a female of this species at Kallar on 22-8-'41. This, I believe, is the first Nilgiri record. Captain Morrison-Godfrey has a pair caught on 23/11 and 9/11 of 1941 which probably belong to this species. I have not yet had an opportunity of identifying these specimens which seem to be rather obscurely marked . . . they may be *P. deva* or *T. jehana* or both.

209. (H59·8) **Pratapa cleobis, God.**

'3,000′ to 4,000′; rare,' Hampson.

Very rare in the Southern Nilgiris: I caught one below Coonoor at 5,400′ on 2-10-'42.

210. (H60·8) **Tajuria melastigma, De N.**

Recorded as rare by Hampson; 2,000′ to 3,000′. I have seen one female in a local collection. This was probably caught on the Mettupalaiyam Ghat.

211. (H60·19β) **Tajuria cippus cippus, F.**

Hampson states that this species is rare in the Nilgiris and appears from 2,000′ to 4,000′. I have not yet seen it.

212. (H61·1α) **Charitra jalindra macarita, Fr**

A very rare insect. I have had the good fortune to collect two: one female from Ketti, 6,500′, in June, and a male from Burliyar, 2,500′, in April. Ketti, in the open lower plateau country, is an extraordinary place in which to have caught this butterfly which is generally taken in the thickest jungles at the foot of the hills. It has the habit of settling on the undersides of leaves.

'Very rare,' Hampson.

'Very rare,' Yates (Coorg).

213. (H70·β) **Charitra freja jaffra, But.**

'Western slopes in September,' Hampson. I have not caught it.

214. (H76) **Rathinda amor, F.**

Not rare at Kallar in May and July and from September to December. Hampson gives it as rare, presumably on the western slopes. Common in the dry jungles round Bangalore.

215. (H77·1∠) **Horaga onyx cingalensis, M.**

Recorded as rare in the Nilgiris by Hampson. Rare in Coorg.

216. (H77·4) **Horaga viola, M.**

'Not rare; 2,000′ to 4,000′,' Hampson (western slopes?). Very rare in Coorg. Possibly Hampson was confusing this species with onyx.

217. (H78·1∠) **Catapoecilma elegans myositina, Fruh.**

Hampson found it fairly common on the western slopes. I have not come across it.

218. (H80·1) **Hypolycaena nilgirica, M.**

'Very rare; one male caught on the western slopes is the only Nilgiri record, Hampson.

'A very rare insect in Ceylon,' Ormiston. Not observed in Coorg.

Although by no means abundant, I have caught or seen at least 15 specimens in the last 18 months at Kallar, mostly settling on wet mud at the ford. Kallar would seem to be the headquarters of this species.

I have caught it in May, July, August and October; but July is the best month.

219. (H81) **Zeltus etolus, F.**

Hampson gives this species as rare on the western slopes. I have not come across it.

220. (H83·1∠) **Deudoryx epijarbas epijarbas, F.**

Rare in the Southern Nilgiris from which I have three records: a male from Runneymede, 5,000′, 6/3, and a male and female from Kallar, 28/3.

Hampson gives it up to 7,000′. It is a fairly common insect in most parts of India.

221. (H84·1) **Virachola isocrates isocrates, F.**

Rare. I have one specimen from Kallar, 28/3, and have seen another on the Nadgani Ghat in December.

222. (H84·2∠) **Virachola perse ghela, Fruh.**

'2,000′ to 4,000′,' Hampson (western slopes?). I have not seen it.

223. (H85·6) **Rapala lankana, M.**

'1,000′ to 3,000′; not common,' Hampson (western slopes?). Very rare in Coorg. I have not seen it.

224. (H85·11∠) **Rapala varuna lazulina, M.**

'Common; 2,000′ to 3,000′,' Hampson (western slopes?). Common also in Coorg but does not seem to appear in the Southern Nilgiris. I have had one male from the Nadgani Ghat at 2,500′ on 6-2-43.

The males of this species are readily distinguished from those of *schistacea* by the shining blue on the upper and lower wings. In *schistacea* these wings are of a duller and darker shot blue.

225. (H85·12) **Rapala schistacea, M.**

'2,000′ to 4,000′; common,' Hampson. This presumably refers to the western slopes as it is very rare elsewhere in the Nilgiris. I have one male from Kallar taken in December.

226. (H85·16) **Rapala melampus**, Cr.

Given by Hampson as appearing from 2,000′ to 7,000′. Rare. I have not caught it.

227. (H87·α) **Bindahara phocides moorei**, Fruh.

Rare. One male caught at Ketti, 6,500′, in March of 1941, is my only record. This was taken settling on flowers well away from its usual haunts. These are the evergreen jungles of the western slopes.

Note.

(H5·5) **Gerydus biggsii**, Dist.

Recorded from Coorg by Yates. Very rare.

(H14·2) **Azanus uranus**, But.

This species probably appears in the Nilgiris.

(H26·1α) **Lycaenesthes emolus emolus**, Fd.

Common in many parts of India. Appears in Coorg and should certainly be found in the Nilgiris.

(H32·2β) **Nacaduba pactolus continentalis**, Fruh.

Yates has recorded this species from Coorg. I gather it has since been found at Karwar where it is apparently not rare. (This information is based on a list issued a year or two ago by Messrs. Fernandez and Dolla of Karwar, who, at that time were selling butterflies from that district).

(H47·α) **Thaduka multicaudata kanara**, Evans.

Appears in Coorg. Will probably be found on the western slopes of the Nilgiris.

(H49·45) **Amblypodia bazuloides**, Hew.

Rare in Coorg. Evans states that it appears in Southern India.

(H56·3) **Apharitis lilacinus**, M.

Found at Bangalore but probably no further south.

(H57·7β) **Spindasis ictis ictis**, Hew.

'India; common,' Evans. Not common in Coorg but fairly common round Bangalore. Should appear in the Nilgiris.

(H59·5α) **Pratapa deva deva**, M.

(H60·18) **Tajuria jehana**, M.

(See *P. blanka sudica*). Neither species was recorded by Hampson from the Nilgiris but Yates had one record of *jehana* from Coorg. *Jehana* is not rare round Bangalore. It is possible that both will be found in the Nilgiris.

(H79·1) **Chilaria othona**, Hew.

Rare in Coorg.

HESPERIDÆ.

228. (I1·13α) **Hasora taminatus taminatus**, Hub.

'3,000′ to 6,000′,' Hampson.

229. (I1·16α) **Hasora alexis alexis**, F.

Found throughout the Nilgiris but it is nowhere particularly common. I have caught it in various localities from Kallar up to Ooty between September and December and in March.

230. (I2·8α) **Ismene jaina fergussoni,** DeN.

I have seen one specimen, probably caught on the Mettupalaiyam Ghat, but definitely caught in the Nilgiris. The date of capture was not given. This is, I believe, the first Nilgiri record.

231. (I3·α) **Bibasis sena sena,** M.

'3,000′ to 6,000′; rare,' Hampson.

232. (I4·4α) **Choaspes benjaminii benjaminii,** Guer.

'Confined to the plateau; two wet season broods only,' Hampson. In the Southern Nilgiris I can add a dry season brood which appears in March and April. I have also caught it in October. As in the Himalayas this is a hill insect here though it is not confined to the plateaux as I have caught it at 5,000′ at Runneymede. It usually flies early or late, or in the shade.

233. (I5·) **Badamia exclamationis,** Fab.

Not uncommon up to 4,500′. During the daytime it usually flies in dense jungle and settles on the underside of leaves. This is a common habit with certain skippers and as these have considerable faith in this type of concealment they are usually easy to catch.

Hampson states that it is caught up to 7,000′ and has two wet season broods only. I have caught it in October, March and April.

234. (I11·3) **Celaenorrhinus ambareesa,** M.

235. (I11·16β) **Celaenorrhinus leucocera leucocera,** Koll.

Both are fairly common and fly early and late in the open, otherwise they keep to deep shade. *Ambareesa* is fond of taking shelter on the underside of boulders and on shady banks etc. I have also seen it feeding on lantana on a cloudy day. I have caught this species at Kallar in March, May, July, August, and October but I have not yet observed it elsewhere. Hampson, however, states that it is found up to 6,000′.

I have caught *leucocera* up to 5,000′ and I believe I have seen it flying in Ooty at 7,500′. Seen in February, March, August, October and December. Quite common.

236. (I11·20α) **Celaenorrhinus ruficornis area,** Plotz.

Hampson states that it is found from 2,000′ to 4,000′ and is not uncommon. I have taken one or two specimens on the Nadgani Ghat in October.

237. (I14·3α) **Tagiades obscuros athos,** Plotz.

Not rare in thick jungle at low elevations. I have seen it in January, February, April, May and December. It is well distributed over the district. Like the previous four species it settles on the underside of leaves.

238. (I14·10β) **Tagiades litigiosa litigiosa,** Mosch.

Has the same habits as the last but is found up to quite 5,000′; it is also commoner and more widely distributed. Found throughout the year.

239. (I16·6*a*) **Daimio bhagava bhagava,** M.

A great rarity. I have caught one specimen which was taken settling on damp mud at the ford at Kallar on 28-3-'42. Recorded by Colonel Winckworth from the same locality.

240. (I20·1α) **Coladenia dan dan,** F.

One of the commonest of our skippers. Abundant from 1,200′ to 5,000′ from June to December. Rare on the lower plateau where I have once seen it in April.

241. (I20·2β) **Coladenia indrani indra,** Evans.

'2,000′ to 4,000′,' Hampson.

I have caught one in the scrub jungle outside Mettupalaiyam, 23/11, and two in thick jungle at Kallar, 7/5. Settles on the underside of leaves and seems to be more of a jungle species than dan.

242. (121·3β) **Sarangesa dasahara davidsoni,** Swin.

'Not common; western slopes, 1,000′ to 3,000′,' Hampson. I have, however, found it quite abundant between 2,000′ and 2,500′ on the Nadgani Ghat in October.

243. (123·β) **Tapena thwaitesi hampsoni,** El. and Ed.

Very rare. One specimen settling on damp mud at the ford at Kallar, 16-7-'41. '2,000′ to 4,000′,' Hampson. Fairly common in Coorg.

244. (125·1) **Odontoptilum angulata sura,** Fd.

Rare. I have one specimen caught settling on damp mud at Kallar on 16-7-'42. '2,000′ to 4,000′,' Hampson. Fairly common in Coorg.

245. (126·1α) **Caprona ransonnetti ransonnetti,** Fd.

246. (126·1β) **Caprona ransonnetti lanka,** Nov.

247. (126·1γ) **Caprona ransonnetti taylori,** De N.

Lanka, a D.S.F., is listed from the Nilgiris by Evans but I have not had it nor have I any further information about its appearance here though I have caught it in Ceylon. *Taylori* is the second D.S.F. and *ransonnetti* is the W.S.F. In the Southern Nilgiris both are common up to 3,500′. They settle freely on damp sand and on the underside of leaves and fly in the sunshine. *Taylori* appears in March, April and May while *ransonnetti* can be caught in July, and from October to January.

248. (126·2α) **Caprona agama pelias,** Fruh

'One specimen, southern slopes,' Hampson. No other information.

249. (127·α) **Gomalia elma albofasciata,** M.

This rare little skipper can be taken in small quantities at Kallar, especially at the ford, but also in other open spots. I have seen several in July and August, and single specimens in November and February. In habit it is very like *S. galba.* I have only it in the Kallar neighbourhood.

250. (128·2) **Syrichthus galba,** F.

Well distributed and common throughout the district, flying close to the ground in open, grassy places. It extends to quite 7,000′.

251. (139 β) **Astichopterus jama mercara,** Nov.

A. jama olivascens is given by Hampson from the Nilgiris: the correct name of the local race is *mercara.* This butterfly is rare in Coorg but quite common on the upper regions of the Nadgani Ghat in October, November and December.

252. (141·1β) **Baracus vittatus subditus,** M.

253. (141·2) **Baracus hampsoni,** El. and Ed.

According to Hampson *vittatus* is common on both the southern and northern slopes and has four broods. So far I have failed to find it. On the other hand *hampsoni* is common on the western slopes in October. Evans states that ***hampsoni*** may be the low elevation form of *subditus* as the latter is only found on the plateau. However in appearance they are very dissimilar.

254. (142·1) **Ampittia dioscorides,** F.

Abundant in May and June at Kallar and up to 2,500′ in the Southern Nilgiris where I have also caught it in April, August and December. It appears in the Western Nilgiris as well and settles readily on low growing shrubs and plants in the sunshine.

255. (143·9) **Aeromachus pygmaeus, F.**

Common at low elevations on the western and southern slopes. I have seen it in fair numbers at Kallar in May and July and occasional specimens in January, June, August, September and November. On the Nadgani Ghat I have observed it in February, October and December.

256. (145·1) **Arnetta vindhiana, M.**

'Common; 2,000′ to 4,000′,' Hampson. I have taken it on the Nadgani Ghat at 2,000′ in October.

257. (146·2α) **Iambrix salsala luteipalpus,** Plotz.

Common up to 4,000′ in the Southern Nilgiris from June to March: very abundant on the western slopes in October.

258. (147·1β) **Suastus gremius gremius, F.**

Rare. I have caught two specimens at Kallar, 1/5 and 6/12. This species will only be found in the neighbourhood of palmaceae. '1,000′ to 6,000′,' (!) Hampson.

259. (147·3α) **Suastus rama bipunctus,** Swin.

'Nilgiris; rare,' Evans.
According to Hampson this species is found on the western slopes.

260. (151·α) **Sancus pulligo subfasciatus, M.**

Hampson gives *Astichopterus pulligo.* I presume this is the same species as the above. He records, '40 specimens between 500′ and 3,000′ in September, 1888.' I have no other record, but this species appears in Coorg.

261. (157) **Udaspes folus,** Cr.

'1,000′ to 7,000′,' Hampson, but I have only known this as a hill species, both here and in the Himalayas. It is not common in the Southern Nilgiris but I have found it quite abundant at the top of the Nadgani Ghat in October. I have records from Ketti in March and October, and from Dodabetta in the latter month.

262. (158·4α) **Notocrypta paralysos alysia, E.**

Found on the northern slopes according to Hampson but is very common on the middle regions of the Nadgani Ghat in October.

263. (158 6α) **Notocrypta curvifasciata,** Fd.

'2,000′ to 4,000′,' Hampson. Rare; I have not seen it. Neither this, nor the last species, seems to appear in the Southern Nilgiris.

264. (159·β) **Gangara thyrsis thyrsis,** F.

Rare. One male from Kallar, 1-3-'42, is my only record. It is reputed to be a minor pest of palm trees at Coimbatore.
'2,000′ to 6,000′ (!); rare,' Hampson.

265. (164·1) **Matapa aria, M.**

At certain times of the year this insect is quite common at Kallar. It never leaves thick jungles during the daytime and will not be found outside the bamboo area. Settles readily on bushes etc. Appears from March to May and from July to August.
'Rare; 2,000′ to 6000′ (!),' Hampson.

266. (166·1α) **Hyarotis adrastus adrastus,** Cr.

'2,000′ to 4,000.′ Not uncommon on the southern slopes: rare on the northern,' Hampson. I have not yet come across this insect.

267. (166·2) **Hyarotis basiflava,** De N.

'Western slopes, 20 specimens, September, 2,000′ to 3,000′,' Hampson. Very rare in Coorg.

268. (183·2) **Halpe hyrtacus,** De N.

Rare. Two specimens from the Nadgani Ghat at about 2,000′, 23/10 and 27/12. Not previously recorded from the Nilgiris.

269. (183·15) **Halpe astigmata,** Swin.

One specimen from the Nadgani Ghat at 2,000′, 23-10-42.

270. (183·18α) **Halpe sitala sitala,** De N.

'3,000′ to 5,000′; very rare,' Hampson.

271. (183·20) **Halpe honorei,** De N.

Not particularly rare at Kallar where I have taken some 12 specimens in the last two years. Settles on flowers and on damp mud, especially at the ford. It apparently appears throughout the year as I have caught it in January, March, May, July, August, October and November.

I have also caught it on the Nadgani Ghat, 2,000′, in October.

272. (183·33α) **Halpe egena ceylonica,** M.

Much the most abundant skipper at Kallar, 1,350′. At times it swarms on wet mud and is found throughout the year. It appears on the Gudalur plateau but is not nearly as common on that side of the Nilgiris.

(*Halpe beturia?*

Species given by Hampson. I cannot trace it. Is it *Halpe moorei moorei*, Watson? This is a Southern Indian species that should be found in the Nilgiris.)

273. (187·α) **Cupitha purreea purreea,** M.

Hampson states that it can be found between 2,000′ and 4,000′, presumably on the western slopes. It is a rarity throughout its range. Also caught in North Kanara and Coorg. I have also seen a specimen caught by Capt. P. Morrison-Godfrey at Kallar.

274. (188·2β) **Taractrocera mævius sagara,** M.

Not rare at Kallar, but does not seem to ascend the ghat to any great altitude. I have taken it in small numbers from June to October and in December and January.

Hampson apparently found it very scarce as he notes, '3,000′, the northern slopes, 4 specimens, July, 1888.'

275. (188·3α) **Taractrocera ceramas ceramas,** Hew.

276. (188·3β) **Taractrocera ceramas lynx,** Mosh.

The former is confined to the plateaux where it is most abundant in open, grassy places especially in May and June and between the two rainy seasons.

Lynx is the low elevation form and is abundant on the Nadgani Ghat where it flies low over grass by the roadside. Common in October.

Evans gives the expanse of *ceramas* as 26 mm.

Lynx is a larger insect, the expanse averaging about 29 mm. It is a much deeper and darker brown above and the spots are of a deeper and richer yellow. The under hindwing is suffused ochreous. *Ceramas* is altogether a paler insect and the under hindwing is suffused brown. *Lynx* would seem to be confined to the western slopes: Evans gives its distribution as Travancore to N. Kanara but does not give any satisfactory description. It is also caught round Gudalur.

277. (189·1) **Oriens concinna,** El. and Ed.

Rather scarce. I have only caught it in the evergreen area of the Mettupalaiyam Ghat. Two specimens at 4,500′ in April and August. Hampson does not mention it.

278. (I89·3α) **Oriens gola goloides,** M.

1,350′ to 6,500′. Common at the edges of the forests overlooking the Mettupalaiyam Ghat; very common on the Nadgani Ghat in October. I have also caught it at Kallar and Ketti.

(I90·9α) **Padraona cato cato,** Evans.
279. (I90·10α) **Padraona pseudomæsa pseudomæsa,** M.
(I90·14β) **Padraona tropica diana,** Evans.
280. (I90·15α) **Padraona palnia palnia,** Evans.

Padraonae are always scarce on the Mettupalaiyam Ghat and I have only had three specimens from there. These seem to belong to two different species though I must admit that identification of this genus is beyond me. These were caught at Kallar 19/2; Burliyar, April; Runnneymede, 19/8.

Cato is very abundant on the Nadgani Ghat in October.

Cato and *pseudomaesa* are now, I believe, recognised as seasonal forms of the same species.

281. (I91·2α) **Astychus pythias lanka,** Nov.

Common where bamboo grows. Found at the southern foot of the Nilgiris throughout the year.

282. (I97.1β) **Baoris oceia farri,** M.

One male, 11/10, on the Nadgani Ghat at 2,000′. This is, I believe, the first Nilgiri record of this species.

283. (I97·14β) **Baoris kumara kumara,** M.

Common in September at Ketti, 6,500′, settling on flowers in sunshine. It is generally distributed and I have caught it at Kallar in October and January, at Runneymede, Gudalur and the Nadgani Ghat in October and November.

284. (I97·20) **Baoris contigua,** Mab.

One specimen from the Nadgani Ghat, 6-2-43. I think this is the first Nilgiri record of this species.

285. (I97·24α) **Baoris conjuncta narooa,** M.

Not as common as *kumara* but has the same habits and is caught with it at Ketti. I have recorded it from Kallar in November, from Ketti in the same month, and from Gudalur and Nadgani in October.

286. (I97·30α) **Baoris sinensis subochracea,** M.

Rather rare in the Southern Nilgiris. I have only had it at Kallar in January and August. Generally keeps to the shade or flies in the early morning and evening.

287. (I97·31β) **Baoris mathias mathias,** F.

Common to about 7,000′. Flies from November to April in the Southern Nilgiris. Common at Gudalur and Nadgani in October.

288. (I97·32β) **Baoris guttatus bada,** M.

'1,000′ to 4,000′,' Hampson. It is curious that I have not come across this abundant skipper.

289. (I97·33β) **Baoris zelleri cinnara,** Wall.

Up to 4,000′. Very abundant almost everywhere below this altitude.

290. (I97·34β) **Baoris bevani bevani,** M.

'2,000′ to 4,000′,' Hampson. Not common. I have not yet caught it.

Notes.

(11·7β) **Hasora badra badra,** M.

Rare in Coorg. 'Southern India and the Himalayas,' Evans.

(11·13α) **Hasora vitta indica,** Nov.

'Not rare. Southern India and the Himalayas,' Evans.

(12·17α) **Ismene gomata kanara,** Evans.

Rare, Coorg. Southern India to N. Kanara.

(160·1β) **Erionota thrax thrax,** L.

Southern India and the Himalayas.

(167·1α) **Kineta microstictum,** WM.

Very rare in Coorg.

(168·3α) **Zographetus oxygia oxygia,** Hew.

Southern India and the Himalayas.

(171·9α) **Plastingia sala kanara,** Evans.

Rare. Southern India and N. Kanara.

(191·1α) **Astychus augias augias,** L.

This species appears in Coorg and Ceylon and should appear in the Nilgiris.

(197·11) **Baoris canaraica,** M.

Rare. Appears in Coorg and N. Kanara.

(197·15β) **Baoris philippina belli,** Nov.

Appears in Coorg and N. Kanara.

APPENDIX.

NOTE ON THE APPEARANCE OF BUTTERFLIES IN THE NILGIRIS.

Total number of species (with varieties and any additional subspecies) recorded from the Nilgiris: 291.

Total number of species recorded from the Southern Nilgiris: 225.

Total number of species recorded from Kallar (24 visits): 192.

Total number of species recorded from the evergreen region of the Mettupalaiyam Ghat (10 visits): 122.

Total number of species recorded from the plateaux and above (observation from permanent residence on the lower plateau and numerous visits elsewhere): 105.

Total number of species recorded from the Nadgani Ghat (6 visits only in October, December and February): 114.

A. Details from the Southern Nilgiris.

(i) KALLAR (1,350′). Occasional visits, April 1941 to February 1943.

Date ...	30/1..	16/2..	19/2..	3/3..	28/3..	4/4..	28/4..	7/5..	15/6..	4/7
Species observed ...	66	63	71	76	77	57	55	51	67	62
Date ...	9/7..	15/7..	16/7..	31/7..	14/8..	22/8..	1/9..	2/10..	10/10..	6/11
Species observed ...	70	75	67	67	73	75	81	79	79	61
Date ...	23/11..	6/12..	7/12..	31/12						
Species observed ...	72	73	72	63						

(ii) KETTI (6,500′). Permanent residence, 1941 to 1943. Monthly figures.

Month	Jan.	Feb.	Mar.	April	May	June[*]	July	Aug.	Sept.	Oct.	Nov.	Dec.
Species observed	21	40	64	66	49	29	22	29	36	63	28	31

B. Details from the Western Nilgiris.

NADGANI GHAT (2,000′ to 3,000′). Occasional visits, October 1942 to February 1943.

Date	6/2	8/2	10/10	11/10	23/10	27/12
Species observed	49	30[†]	56	57	78	43

ADDENDUM

291 (F33·β) **Doleschallia bisaltide malabarica**, Fruh.

Several recorded from Walayar R.F. near Coimbatore.

MATERIALS FOR THE ORNITHOLOGY OF AFGHANISTAN.

BY

HUGH WHISTLER (Deceased).[‡]

PART II

(*Continued from Vol.* xliv, *No.* 4 (1944), p. 519).

[Larvivora brunnea Hodgson.

Whitehead found the Indian Blue Chat breeding along the lower slopes of the Safed Koh between 6,500 ft. and 8,000 ft. so it is quite likely to occur over the border in Afghan territory.]

Saxicola caprata bicolor Sykes.

Specimens collected.—♀ ♂♂♂ 17-30 March, 3 ♀ 2 ♂ 1-18 April 1881 Kandahar (Swinhoe). ♂♀ 12-13 April Tirphul, Hari-Rud, ♂ 13 April Khusan, Hari-Rud, ♀ 29 April 1885 Kambas, Badghis (Aitcheson); ♂ 19 March Maruchak, 2 ♂ 9-19 April Karawal Khana, ♀ 13 May Kila Wali Morghab (Yate); ♂ 7 August Doshi 2,700 ft., ♂ 21 Sept. 1934 Ashraf, 4,000 ft. (Maconachie); ♂ 9 April Paghman 8,000 ft., 2 ♂ 1 ♀ 1 May Doshi 2,750 ft., ♂ 6 May Danaghori 2,300 ft., ♂ 18 May Baghlan 2,000 ft., ♂ 20 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

The status of the Pied Bush-Chat in Afghanistan is not altogether clear. In the north on the Morghab, in Badghis and on the Hari-Rud the dates of the above specimens suggest that it is merely a summer visitor as in Turkestan and extreme north-west India, and this would agree with Meinertzhagen's experience. Except for a single migrant shot on 9 April at Paghman, he did not meet with the species until he reached Doshi after which it was fairly common in suitable country, and breeding. None were seen at Haibak.

Towards Seistan it is apparently scarcer and also perhaps only a summer visitor as Cumming only mentions a pair taken with their eggs at Kuhak on 7 May 1905 and a male obtained previously in the same place on 23 April 1905.

About Kandahar, however, it is definitely common (Swinhoe) and found throughout the year (Hutton) though St. John implies that it is more numerous in winter, a few only remaining to breed. This is at variance with the status of the bird in the North-West Frontier Province and Baluchistan and there may be some mistake about it.

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[*] In June, after the break of the S. W. monsoon, I have only observed 19 different species.

[†] Under perfect weather conditions.

[‡] This paper, submitted for publication before the author's death, was held up for want of space. Proofs have now been corrected by Mr. N. B. Kinnear whose minor alterations and corrections are here embodied.—EDS.

Saxicola torquata indica (Blyth).

Specimens collected.—2 ♂ Chughar Serai (Griffith); ♂ ♀ 21 April 1873 Panjab (Biddulph); ♂ 29 Jan. 1879, ♂ 30 Jan. 1879, ♂ 2 March 1879, ♀ [♀] 4 March 1879, [♂] 6 March 1879, ♂ 22 Nov. 1879, ♀ [♀] 3 January 1880 Kandahar (St. John); ♂ 26 April 1879, ♂ ♀ ♀ 28 May Byan Khel, juv. 18 June 1879 Zubberdust Killa (Wardlaw-Ramsay); [♂] 16 Jan. 2 ♂ 2-21 February [♂] 16 April 1881 Kandahar (Swinhoe); 4 ♂ 2 ♀ 5-11 March 1885 Gulran (Aitcheson); 2 sex? 6 March Kara Baba, Maimanah, 2 sex? 18-24 March Maruchak, sex? 27 March Khwaja Gogerdak Murghab, sex? 9 April Karawal Khana Badghis (Yate); ♀ 30 March 1933, ♂ 28 April 1933 Kabul 5,700 ft., ♂ ♀ 6 May 1934 Chaharasia 5,700 ft., ♀ 9 May 1934 Kabul, ♂ 18 Sept., ♂ 20 Sept. 1934 Ashraf 4,000 ft. (Maconachie); 3 ♂ 3 ♀ 4-7 April Kabul 6,000 ft., 3 ♂ 15-18 April Ghorband, 2 ♀ 1-2 May 1937 Doshi 2,750 ft. (Meinertzhagen).

The status of the Indian Stone-Chat in Afghanistan is again not very clear. In the north it appears to be a summer visitor and Meinertzhagen found a few pairs breeding early May at Doab and Doshi as well as in the Ghorband Valley at the end of May. He did not see it at Haibak or Kunduz. The various specimens enumerated above from Badghis, the Morkhab and the Wakhan may from their dates have been either on passage or on their breeding grounds. Griffith notes in his Journals that several arrived at Kooner near Pashat on 31 March 1840. He also noted it at Chughur Serai on 6 April. At Bamian Meinertzhagen found huge numbers passing through between 22 and 24 April.

Whether it breeds actually about Kabul is not clear. Maconachie noted it as in pairs by 28 April but Meinertzhagen who found it fairly common there in early April did not meet with it towards the end of May.

Further to the South-east Wardlaw-Ramsay found it breeding in the Hariab Valley at 7,000 ft.-8,000 ft. about Byan Khel where he considered it one of the most common birds in the open country. Eggs were taken in May.

In the Kandahar area, on the other hand, both Swinhoe and St. John speak of it as a fairly common winter visitor.

I have examined a number of the above enumerated specimens and cannot separate them in colour and size from Himalayan birds.

Saxicola macrorhyncha (Stoliczka).

Specimens collected:—♂ 19 April 1881 Kandahar, ♀ 24 April 1881 Dubrai (Swinhoe).

The above specimens provide the only records of Stoliczka's Whinchat in Afghanistan.

[**Œnanthe monacha** (Temminck).

The Hooded Chat is said to occur in Afghanistan in the *New Fauna* (vol. ii, p. 40) but I am unable to trace the authority for the statement.]

Œnanthe alboniger (Hume).

Specimens collected.—3 sex? winter 1880 Kandahar (Murray); ♂ 28 November, sex? Dec., ♂ 26 December 1880, ♂ 22 January 1881 Kandahar (Swinhoe); ♂ 6 November 1884 Zagin (Aitcheson); ♂ n.d. Kaod on Asiaki Canal, ♀ 7 December 1918 Lab-i-Baring (Cumming).

Hume's Wheatear is presumably a resident in Afghanistan but little is known about it. Aitcheson obtained a male at Zagin on 6 Nov. 1884. Cumming noticed a pair in the mission camp at Kuhak, Seistan on 12 March 1905 and found that they stayed there several days before disappearing again, while Annandale considered it very common in the Seistan desert in December. At Kandahar Swinhoe found it common throughout the winter until the middle of February. St. John considered it to be a resident there but this was, I think, due probably to confusion with *Œ. picata*.

Œnanthe picata (Blyth).

Specimens collected.—♀ Afghanistan (Griffith); [♀ ♀] Ghuznee (Gould); ♂ 3 February, 3 ♂ 2 March, ♂ 4 March, ♂ 27 April, ♂ 9 May, ♂ ad. and juv. 17 May, ♂ 27 November 1879 Kandahar (St. John); ♂ 12 March, 1885 Gulran

(Aitcheson); ♀ 24 May 1934 Kabul (Maconachie); 2 ♂ 4-7 April Kabul 6,000 ft., 2 ♀ 27-28 April 1937 Doab 5,000 ft. (Meinertzhagen).

The Pied Wheatear is probably both a summer visitor and a passage migrant (to East Persia) in Afghanistan. At Kandahar, at any rate, St. John states that it arrives in very early spring and breeds at once, a fact that is substantiated by the above series though it is curious that Swinhoe apparently never met with it.

In North Baluchistan this Wheatear is one of the most abundant of the genus arriving early in March and having eggs by April 12. It also breeds on the Samana (Whitehead *Ibis*, 1909, p. 216). It seems highly probable therefore that when Meinertzhagen found this species common in Kabul, in the Ghorband and Bamian Valleys and at Doab it was probably on its breeding ground though he does not say so specifically.

Œnanthe capistrata (Gould).

Specimens collected.—3 ♂ Afghanistan, ♂ Pashat (Griffith); ♂ 2 March, ♂ 5 March, ♂ 21 March 1897 Kandahar (St. John); ♂ 15 April Ghorband 6,500 ft., 3 ♂ 2 ♀ 27-29 April Doab 5,000 ft., 3 ♂ 1 ♀ 1 juv. 15-17 May 1937 Haibak 3,000 ft. (Meinertzhagen).

I have only included in the above list the specimens which I have seen myself from Afghanistan and the series enumerated by Meinertzhagen. A number of other specimens have been recorded under the name of *morio* but I have omitted these as they are not at the moment available for examination and there is some confusion amongst the older writers as to the birds they identified as *morio*. Also some workers have not always been able to identify these Wheatears correctly. Whitehead for instance recorded (*Ibis*, 1909, p. 217) that *capistrata* breeds in the Kurram Valley but his only specimen in corroboration of this (no. 302. ♂ juv. Parachinar, 5,700 ft., 7 July) is in the British Museum and is in fact an adult ♂ of *Œnanthe pleschanka*. One is therefore left in ignorance as to the identity of the Wheatear which under the name of *morio* Wardlaw-Ramsay noted as breeding commonly in the Hariab Valley at 7,000-8,000 ft. It may well be *pleschanka*.

Meinertzhagen's specimens which include a juvenile suggest that it breeds in the Haibak area. For the rest it is not clear whether his birds were on passage or on their breeding ground. St. John, however, is quite definite that in the Kandahar area it is a passage migrant—he states that it is abundant on its way to and from its summer quarters, that he shot several specimens in Kandahar from March 2 onwards, and that Colonel Swinhoe was mistaken in considering it a summer visitor.

My own opinion is that *picata* will be found to be the breeding bird of Gilgit, Baltistan, the hills of the N.-W. Frontier Province, Baluchistan and central and southern Afghanistan and that *capistrata* replaces it as a breeding bird from the Oxus Valley northwards.

Œnanthe opistholeuca (Strickland).

Specimens collected.—♂ 2 March ♀ 3 March 1879 Kandahar (St. John); ♂ 18 March 1885 Gulran (Aitcheson); sex? 20 March Maruchak (Yate); [♂] 12 April 1933 Kabul, [♂] ♀ 10 July 1933 Panjshir 5,500 ft. (Maconachie); 9 ♂ 4-7 April Kabul 6,000 ft. (Meinertzhagen).

Strickland's Chat is another wheatear whose status in Afghanistan is not very clear. Maconachie obtained it at Kabul in April and again at Panjshir in July remarking that it was very common on the latter occasion but he may have confused it with *picata*. Meinertzhagen found it common in Kabul in April. Aitcheson and Yate obtained it at Gulran and Maruchak after the middle of April. At Kandahar Swinhoe did not apparently meet with it though St. John says that he procured 2 specimens in February and March 1879 but that it was rare. It is perhaps a passage migrant in Afghanistan.

Œnanthe finschii barnesi (Oates).

Specimens collected.—♂ 12 Sept. 1879 Kandahar (St. John); ♂ 3 February 1881 Kandahar (Swinhoe); sex? 14 March Kara Bala, Maimanah, ♂ March north of Gulran (Yate); ♂ 6 April Kabul 6,000 ft., ♂ ad. 2 juv. 14-17 May 1937 Haibak 3,000 ft. (Meinertzhagen).

The above records express all that was known of Barnes's Chat in Afghanistan before Meinertzhagen's expedition. He was of opinion that the single bird obtained at Kabul on 6 April was on passage as none were seen about Kabul on the return in May. The species was found to be breeding, however, in the lower reaches of the Dar-e-Shikari (below 7,000 ft.) and at Doab and Doshi, where parents carrying food were seen on 2 May. Thence to Haibak and Kunduz the bird was seen wherever the country was stony, steep and desolate. At Haibak on 12 May there were many young out of the nest and a female obtained had an egg in the oviduct.

Œnanthe pleschanka pleschanka (Lepschin).

Specimen collected.—♀ 22 April 1937 Bamian (Meinertzhagen).

This is the only authentic record of the Siberian Chat in Afghanistan and it was no doubt on passage.

Œnanthe œnanthe rostrata (Ehrenberg).

Specimens collected.—3 ♂ 4 ♀ 14-23 April 1874 Panja (Biddulph); ♂ 19 March 1885 Gulran, 2 ♂ 2 ♀ 6-16 April 1885 Tirphul, ♂ juv. 4 May 1885 Shore-Kaltegai, Badghis (Aitcheson); ♂ 10 June 1934 Sar-i-Chasma 10,500 ft. (Maconachie); 2 ♂ 17 April Ghorbund, ♂ ♀ 25 May 1937, Shibar Pass 9,000 ft. (Meinertzhagen).

The Common Wheatear evidently is both a summer visitor and a passage migrant in Afghanistan. In addition to the evidence of the earlier records cited above Meinertzhagen found a nest with eggs on the Shibar Pass at 9,000 ft. and secured the pair of birds after some curious behaviour on their part (which he relates); he again found 2 or 3 pairs breeding in the Unai Pass at 12,500 ft. on 29 May. Of passage birds he observed a party of 5 at Ghorband 8,200 ft. on 17 April and about twenty males at Bamian on 23 April.

Œnanthe isabellina (Temm. & Laug.).

Specimens collected.—one sex? Afghanistan (Griffith); ♂ 29 January 1879 Kandahar (St. John); ♀ 3 January, ♂ 17 March, ♂ 10 April 1881 Kandahar, ♀ 25 April 1881 Dubrai (Swinhoe); 2 sex? 4-17 April Chahar Shamba, 1 sex? n.d. Khwaja Gogirdak (Yate); ♀ 31 March 1904, ♂ 3 April 1904 Kuhak (Cumming); sex? 5 September 1933 Farakhulm 9,300 ft. (Maconachie); 4 ♂ 4-7 April Kabul 6,000 ft., 4 ♂ ad. juv. ♀ 14 May Haibak 3,000 ft., ♀ ad. ♂ juv. 21 May 1937 Kundaz 1,800 ft. (Meinertzhagen).

The Isabelline Wheatear evidently breeds in small numbers generally throughout Afghanistan. In the north it is probably a summer visitor only and Meinertzhagen states that his specimens taken at Kabul 4-7 April were on passage. About Kandahar on the other hand St. John calls it a resident and specimens were collected by him and Swinhoe in January.

Koelz collected adults and young in July and August on the Kargasi Pass, Zebak, Minjan Pass and Teshkan Pass in N.-E. Afghanistan and also from Gardez and he separated the former as *Œnanthe isabellina kargasi* (Proc. Biol. Soc., Washington, vol. 52 (5 June 1939) p. 66. The characters suggested for it do not however sound very reliable.

Œnanthe deserti atrogularis (Blyth).

Specimens collected.—♂ Afghanistan (Griffith) ♀ 3 Oct. 1879, ♂ 2 [♀] Oct. 1879 Kelat-i-Ghilzai (St. John); ♂ 13 March 1881 Kandahar (Swinhoe); ♂ 9 Nov. 1884 between Karez-dasht and Ser-Mandel, ♂ 6 April 1885 Tirphul (Aitcheson); ♂ 19 March Maruchak (Yate); ♂ 3 April 1903, ♂ January 1905 Khwaja Ahmed (Cumming); sex? 7 December 1918 ♂ 8 Dec. 1918 Lab-i-Baring (Annandale); [♂] 22 Oct. 1933 Ghazni Road 7,000 ft. (Maconachie).

The status of the Desert Wheatear in Afghanistan is not very clear but it probably does not breed in the country. Aitcheson and Yate obtained it in the north at Maruchak (19 March), Tirphul (6th April) and between Karez-dasht and Ser Mandal (9 Nov.). In the Seistan desert it was very common in December according to Annandale who also reports it in January and April at Khwaja Ahmed. As regards Kelat-i-Ghilzai and Kandahar both Swinhoe and St. John do not commit themselves beyond the statement that it is found in desert places.

Œnanthe deserti oreophila (Oberholser).

Specimens collected.—4 ♂ 14-16 April 1874 Panja (Biddulph); ♂ 26 April 1881 Gatai (Swinhoe); ♂ 22 Oct. 1933 Ghazni Road 7,000 ft.; [♂] 19 Oct. 1934 Karganathon 10,200 ft. (Maconachie).

The only records of this race of the Desert Wheatear in Afghanistan. The last specimen is intermediate in character as regards both wing length (99 m.) and amount of white on the primaries but on the whole it is nearer to this subspecies.

Œnanthe xanthoprymna chrysopygia (De Filippi).

Specimens collected.—2 sex? 13-23 April 1874 Panja (Biddulph); sex? Oct. 1879 Khelat-i-Ghilzai (St. John); ♂ 16 Dec. 1879 Kandahar (St. John); ♂ 26 Dec. 1880, ♂♂♀ 8-22 January 1881 Kandahar (Swinhoe); ♂ 24 Sept. 1933 Paghman 7,500 ft., juv. ♀ 25 August 1934, Paghman 12,000 ft. (Maconachie); 3 ♂ 2 ♀ 4-7 April Kabul 6,000 ft., 7 ♂ 3 ♀ 7-12 April 1937 Paghman 8,000 ft. (Meinertzhagen).

Meinertzhagen says.—'One of the commonest birds in the hills surrounding Kabul from early April on, confining itself to the most barren and stony parts. They were observed carrying nesting material in the Paghman Valley on 9 April. They were also one of the commonest birds in the Ghorband Valley up to at least 8,600 ft. and here again they were commencing to nest on 16 April. In the Bamian Valley still common and noted up to 11,800 ft. on 25 April. A few were seen in the Dar-e-Shikari down to about 5,500 ft. after which none were seen.' He goes on to describe the failure to locate actual nests. The Panja birds obtained by Biddulph may have been a passage.

In Southern Afghanistan St. John states that the Red-tailed Wheatear is a winter visitor, but not common, all over the province of Kandahar and St. John's and Swinhoe's specimens agree with this statement.

[**Phœnicurus frontalis** Vigors.

The Blue-fronted Redstart is said to breed in Afghanistan in the *New Fauna* (ii, p. 69). I can find no evidence to that effect.]

Phœnicurus erythronotus (Eversmann).

Specimens collected.—♂♀ Pashat (Griffith); ♂ April 1874 Panjah (Biddulph); 2 ♀ 21 Jan., ♂♀ 28 Jan., ♂ 30 Jan., ♀ 16 March, ♀ 10 Nov., ♂ 19 Nov., ♂ 12 December 1879 Kandahar (St. John); ♂ 24 Jan. 2 ♂ December 1880, 2 ♂ 2♀ January, ♂ 2 Feb., 1881 Kandahar (Swinhoe); sex? 3 March Chahar Shamba, sex? 20 March Andkhui (Yate); ♂ 1896 Shili Kach (Maynard); [♀] 18 Dec. 1918 Nasratabad (Annandale); ♂ 21 Nov. 1933 Chahiltan 5,800 ft., ♂ 6 March 1934 Kabul (Maconachie).

Eversmann's Redstart may perhaps breed in parts of Northern Afghanistan where Biddulph obtained it in the Wakkan in April, Griffith obtained it at Pashat, Maconachie obtained it at Chahiltan (21 Nov.) and at Kabul (6 March) and Yate got it at Chahar Shamba and Andkhui in March. About Kandahar, however, it is a very numerous winter visitor (Swinhoe and St. John), occurring at least from December to February. As Annandale obtained it just on the western border at Nasratbad in December it may occur in winter throughout the whole of Southern Afghanistan.

The male collected by Griffith and now in the British Museum is the type of *Ruticilla rufogularis* [*Cat. Birds Ind. Mus.*, vol. i, p. 306 (1854)].

Phœnicurus ochruros phoenicuroides (Horsfield & Moore).

Specimens collected.—♀ Pushut (Griffith); 4 ♂ 14-23 April 1874 Panjah (Biddulph); ♂ 24 Jan., ♂ 27 Dec. 1879, ♂ 9 Jan 1880 Kandahar; juv. 19 June 1881, Forest Kawao (St. John); ♂ 9 Jan. 1881 Kandahar (Swinhoe); ♂ 8 Nov. 1884 Sang-bar, 2 ♂ 18 March Gulran, ♀ 12 April 1885 Tirphul (Aitcheson); sex? 8 Oct. Deh Tang, Ghorbund (Yate); ♀ 1896 Shorawak (Maynard); ♂ 9 April Chahiltan 5,900 ft., ♀ 4 September Unai Pass 11,000 ft., ♂ imm. 26 Sept. 1933 Khairkhana 6,500 ft., ♂ imm. 22 Sept. 1934 Ashraf Valley 4,300 ft. (Maconachie); 5 ♂ 4-11 April Kabul 6,000 ft., 5 ♂ 8-9 April Paghman 8,000 ft. ♂ 15 April 1937 Ghorband 6,500 ft. (Meinertzhagen).

The Black Redstart breeds at high altitudes in most of the Afghan ranges. In the north Biddulph found them very common in Wakhan. Meinertzhagen found them common and in obvious pairs, cocks singing and every sign of early nesting, in the Ghorband and Bamian Valleys up to over 12,000 ft. At the end of May he found them breeding in the Paghman Valley near Kabul and in the Unai Pass at 12,000 ft. They did not seem to extend, he adds, north of Doab or below 10,000 ft. St. John obtained a juvenile on 19 June in the Kawao Forest. This bird also breeds along the Safed Koh. Wardlaw-Ramsay met with a pair (and found what he believed to be their empty nest) at 12,500 ft. and later Whitehead found it breeding there above 10,000 ft.

For the rest this bird would seem to be a winter visitor to the lower areas, both north and south of the Hindu Kush, along the northern frontier and certainly about Kandahar where Hutton, St. John and Swinhoe found it very common.

Meinertzhagen found it not uncommon round Kabul from 4 April, becoming more abundant on 9 April and still more so by 12 April, the males largely predominating. These birds were presumably moving up to their breeding altitude.

[**Phœnicurus erythrogaster grandis** (Gould).

I have no more exact record of Güldenstadt's Redstart beyond the fact that Afghanistan is the type locally of *Ruticilla grandis* Gould, Proc. Zool. Soc. London, xvii (1850), p. 112.]

Chaimarrhornis leucocephalus (Vigors).

Specimens collected.—♂ Afghanistan (Griffith); ♂ 13 July 1933 Top of Khawak Pass 9,500 ft. (Maconachie).

In his Journal Griffith mentions seeing the White-capped Redstart at Bala Chugur Serai on 7 March 1840 and this was probably the locality for his specimen formerly in the East India Company's Museum but no longer traceable. Maconachie's specimen suggests that this species breeds on the high ranges but Meinertzhagen failed to meet with it. Whitehead found it abundant in summer along the torrents of the Safed Koh up to tree-limit.

[**Rhyacornis fuliginosa** (Vigors).

The Plumbeous Redstart is stated in the *New Fauna* (vol. ii, p. 81) to occur in Afghanistan. I can find no evidence to that effect.]

Luscinia megarhynchos hafizi Severtzow.

Specimen collected.—♀ 8 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

Meinertzhagen obtained a pair of Nightingales in the village of Dana on the fringe of the Danaghori Plains. They were in typical Nightingale country, a spinney with a stream running through it, and were doubtless about to breed as the male was in full song. He was unfortunately too damaged for preservation. A summer visitor of course.

Irania gutturalis (Guérin).

Specimens collected.—♀ 24 May 1934 Kabul 5,900 ft. (Maconachie) ♂ 23 April 1937 Bamian 8,500 ft. (Meinertzhagen).

'A pair arrived at Bamian on 23 April and were sheltering in a thorn thicket in company with other small migrants' (Meinertzhagen). The testes were much enlarged. The only other record is provided by Sir R. Maconachie's bird.

Cyanosylvia svecica svecica (Linnaeus).

Specimens collected.—♂ 26 April 1879 Byan Khel (Wardlaw-Ramsay); ♂ 16 March 1879 Kandahar (St. John); ♂ 25 April 1885 Tirphul (Aitcheson).

Cyanosylvia svecica pallidogularis (Zarudny).

Specimens collected.—♂ Afghanistan (Griffith); ♂ 16 March 1879 Kandahar (St. John); ♂ 23 March 1885 Gulran (Aitcheson); ♀ 3 September 1933 Paghman, 2 ♂ 3 April Logar, ♀ 30 April ♂ 25 May 1934 Kabul (Maconachie); 2 ♂ 17 April Ghorband, 3 ♂ 20 April Bamian ♀ 29 April 1937 Doab (Meinertzhagen).

Cyanosylvia svecica saturatior (Buturlin).

Specimens collected.—♀ 6 April Kabul, 2 ♂ 7 May 1937 Danaghori (Meinertzhagen).

Cyanosylvia svecica kobdensis Tugarinow.

Specimen collected.—3 ♂ 15 April Ghorband, ♂ 23 April 1937 Bamian (Meinertzhagen).

Cyanosylvia svecica abbotti (Richmond).

Specimens collected.—♂ 29 March, ♂ 30 March 1933 Kabul (Maconachie).

Cyanosylvia svecica subsp. ?

Specimens collected.—♀ Kunar near Pashat (Griffith); sex? 16 April 1874 Panjah, Wakhan (Biddulph); sex? 18 March Maruchak, sex? 24 March, sex? 9 April Karawal Khana, sex? 31 May Yedikul, Maimanah (Yate); ♀ 18 April, Kandahar ♂ 1 October 1879 Kalat-i-Ghilzai (St. John); ♂ 19 March 1881 Kandahar (Swinhoe); 2 ♂ 11 April 1885 (Aitcheson).

At present there seems to be no proof that any form of Blue-throat breeds in Afghanistan and with the exception of St. John's bird of 1 October 1879 from the Kalat-i-Ghilzai and Maconachie's bird obtained at Paghman on 3 Sept. 1933 all the birds obtained or recorded may well have been on spring migration. On this passage they are very numerous. Wardlaw-Ramsay speaks of them as 'so common' in the Hariab Valley 7,000-8,000 ft. in April and the commencement of May. Meinertzhagen found them common round Kabul and the surrounding hills up to 8,000 ft. in early April, common in the Ghorband Valley in mid-April, abundant at Bamian on 22 April and 'in incredible numbers' there on 23 April. Only odd birds were seen at Doab on 29 April and at Danaghori on 10 May and a pair at Haibak on 13 May. St. John found them common at Kandahar but Swinhoe merely met one male there on 19 March 1881.

The identification of Asiatic Bluethroats racially is a matter of great difficulty and the above identifications must be regarded as merely tentative. They include Meinertzhagen's identifications which he made at Leningrad with the help of Tugarinow's material.

[**Calliope pectoralis pectoralis** Gould.

I can find no authority for the statement in the *New Fauna* (vol. ii, p. 93) that the Himalayan Rubythroat is found in Afghanistan.]

[**Ianthia cyanura** (Pallas).

Whitehead found some race of the Red-flanked Bush-Robin fairly numerous in summer on the wooded slopes of the Safed Koh from 8,000 to 10,000 ft. It must, therefore, certainly occur in Afghanistan though as yet unrecorded.]

Adelura cœruleocephala (Vigors).

Specimens collected.—♂ 9 May, ♀ 22 May, 1879 Byan Khel (Wardlaw-Ramsay).

The Blue-fronted Redstart is only known from the extreme eastern border of Afghanistan where Wardlaw-Ramsay found it tolerably common in the Hariab Valley about 7,000-8,000 ft. near Byan Khel. He found a nest with 4 eggs on 22 May, verified by the above female, and shot a juvenile on the Peiwar spur on 21 June. Whitehead found it breeding on the Safed Koh from 7,500-12,000 ft.

[**Saxicoloides fulicata cambaiensis** (Latham).

Specimen collected.—♂ Afghanistan (Griffith).

The occurrence of the Indian Robin in Afghanistan appears to need verification.]

Turdus merula intermedia (Richmond).

Specimens collected.—♂ ♀ 10 December 1880, ♂ ♂ ♀ January 1881, ♀ ♀ 5 February 1881 Kandahar (Swinhoe); ♀ 22 Nov. 1884 Khusan, ♂ 14 December 1884 Bala-Murghab (Aitcheson); ♂ 2 February, ♀ 12 February Chahar Shamba (Yate).

The above specimens have always been accepted as belonging to the Turkestan race *intermedia* which was considered to be a winter visitor in Afghanistan. At Kandahar it certainly is common in winter according to St. John and Swinhoe. Mr. Koelz, however, identified a series of winter Blackbirds which he obtained in Kandahar (Oct. 12-23), Balamurghab (Nov. 15), Maimana (Nov. 16) and Balkh (Nov. 30-Dec. 3) as the same as a single breeding female which he obtained at Farakar on 6 July, 1937. To this he gives the name *Turdus merula brodkorbi* (Proc. Biol. Soc., Washington, vol. 52 (5 June 1939), p. 67). Some form of Blackbird, possibly *Turdus merula maxima* (Seebohm), evidently breeds in small numbers along the eastern border of Afghanistan as Whitehead secured a juvenile at 10,500 ft. on the Safed Koh on 1st July. The whole question of Blackbirds in Afghanistan requires re-examination.

[**Turdus rubrocanus** Gray.

Whitehead met with a family party of the Grey-headed Ouzel on the 9th August on the Safed Koh at 8.000 ft., so this species must doubtless occur within the Afghan boundary.].

Turdus ruficollis ruficollis Pallas.

Specimen collected.—♀ Pushut (Griffith).

There is no other record of the Red-throated Thrush.

Turdus ruficollis atrogularis Jarocki.

Specimens collected.—♂ ♀ 3 November 1884 Kushkrud to Kin, 2 ♂ 3♀ 13-29 January 1885 Bala-Murghab (Aitcheson); 5 specimens 25-28 Jan., 22 February and 4 April Chahar Shamba, Maimanah (Yate); [♂] 13 Nov. 1933 Kabul 5,700 ft., ♂ 2 December 1933 Chahiltan 5,900 ft., ♀ 30 September 1934 Chahiltan (Maconachie); ♀ 11 April 1937 Kabul 5,800 ft. (Meinertzhagen).

The Black-throated Thrush is a winter visitor to Afghanistan and, as St. John notes and as is also the case in North-West India, its numbers vary greatly in different years. It is very common in some years. The above records from 30 September to 11 April suggest its extreme dates of arrival and departure.

Turdus viscivorus bonapartei Cabanis.

Specimen collected.—♂ 23 July 1933, Foot of Khinjan Pass 10,000 ft. (Maconachie).

In addition to the above specimen we have the certainty that the Missel-Thrush breeds on the Safed Koh as Wardlaw-Ramsay found a nest with 4 young on May 22 near Byan Khel. Whitehead says it breeds not uncommonly on the Peiwar Spur and in the Spin Khwar nullah from 7,000 ft. to 9,000 ft.

Monticola saxatilis (Linnaeus).

Specimens collected.—2♂ 12 March 1885 Gulran, ♀♂ 11-12 April 1885 Tirphul, 4 ♂ 1♀ 13-20 April 1885 Khusan, ♀ 27 April 1885 Tomam-Agha, Hari-Rud (Aitcheson); ♀ 7 July 1933 Shibar area, 9,400 ft., ♂ 10 June 1934 Sar-i-Chashma 10,500 ft. (Maconachie); ♂ 12 April Paghman 8,000 ft., ♂ 17 April Ghorband 8,200 ft., ♂ 25 May Shibar Pass, ♂ 29 May 1937 Unai Pass 12,000 ft. (Meinertzhagen).

The Common Rock-Thrush is evidently a summer visitor to the mountain areas of Afghanistan though it does not appear to be very abundant. Maconachie found it in the Shibar area and the Sar-i-Chashma in June and July and Meinertzhagen was satisfied that his birds at Paghman, Ghorband, the Shibar Pass and the Unai Pass were on their breeding ground. St. John says that he got a specimen in the Amadun Valley 6,500 ft. in June.

In enumerating his specimens (above) Aitcheson says that this Rock-Thrush was very common in the Badghis in summer but the dates suggest that he was really witnessing a 'rush' of migrants on their way to the breeding grounds in Central Asia.

Monticola cinclorhyncha (Vigors).

The Blue-headed Rock-Thrush is another Himalayan form which is so far only known to occur on the extreme eastern border of Afghanistan where Wardlaw-Ramsay found it abundant in the Hariab Valley 7,000 ft.-8,000 ft. It must there be a summer visitor and he states that it arrived about the beginning of May, and was apparently breeding in June. Whitehead mentions meeting a few on the Safed Koh.

Monticola solitaria longirostris (Blyth).

Specimens collected.—♂ Siriab, 2 sex? Afghanistan (Griffith); ♂♀ 5 May 1879 Byan Khel (Wardlaw-Ramsay); ♂ juv. 23 June 1879 near Kandahar (St. John); ♂ 24 December 1880, ♂ 24 January ♂ 1 February ♂ 3 February 1881 Kandahar (Swinhoe); ♂ 15 March 1885 Gulran (Aitcheson); sex? 18 May Darband-i-Kil Rekhta, Murghab, sex? 12 July sex? 1 September Shadian (Yate); ♀ 7 April 1903 Khwaja Ahmed (Cumming); 2 ♂ 1 ♀ 6-11 April Kabul 5,600-6,000 ft. ♀ 14 April Ghorbund 6,500 ft., ♀ 26 April Akrobat 9,000 ft.,

♂♀ 30 April Doab 5,000 ft., ♂ 17 May Haibak 3,000 ft., ♂♀ 27 May 1937 Paghman 8,500 ft. (Meinertzhagen).

The Blue Rock-Thrush is fairly well distributed as a breeding bird in summer in Northern Afghanistan at heights from 3,000 ft. to 12,000 ft. Meinertzhagen first noted it in the Tangi Gharo near Kabul on 11 April and saw birds carrying nesting material at the end of April and food at the end of May. It also must breed in small numbers at Kandahar as Swinhoe's bird of 23 June is in juvenile plumage and was evidently hatched locally. Wardlaw-Ramsay says that a few pairs remained throughout the summer in the Hariab Valley at 7,000-8,000 ft.

As both Swinhoe and St. John report the bird as a common winter visitor in Southern Afghanistan one would presume that the birds which breed in Northern Afghanistan are summer visitors there.

Meinertzhagen considers that Kabul birds are intermediate between *longirostris* and *pandoo* and that the Shibar Pass is the boundary of pure *longirostris*.

Myiophonus cœruleus temmincki Vigors.

Specimens collected.—sex? Afghanistan (Griffith); ♀ 20 December 1880 Kandahar (Swinhoe); ♂♀ Bala-morghab 14 December 1884, 2♀ 6 December 1884 between Palounda and Karez-darra (Aitcheson); ♂ 15 September 1933 Killa Tak 9,500 ft. ♂ 11 December 1933 Logar 5,700 ft. (Maconachie); ♀ 11 April Kabul 5,000 ft., ♂ 16 April Ghorband 8,200 ft., ♂ 18 April 1937 Ghorband, 8,200 ft. (Meinertzhagen).

As in North-west India the Himalayan Whistling-Thrush doubtless breeds in the hill ranges and wanders into the neighbouring foothills and plains in winter. Griffith records in his Journals that he saw it a Bala Chaquar Serai on 7 March and at Bharowal on 10-12 April 1840. Maconachie procured it at Killa Tak (15 September) and Logar (10 December). Meinertzhagen met it wherever suitable country existed from the Kabul area to Doab but not further north. In the extreme north-west Aitcheson found it very common in the pistacio forests of the Badghis, obtaining the four specimens enumerated. Finally at Kandahar Hutton procured it in December, St. John in March 1879 and Swinhoe on 20 December 1880 and it was seen on one or two other occasions.

Meinertzhagen identifies his specimens on their wing measurements as *M. c. turcestanicus* but I can match his measurements with Himalayan specimens.

[**Prunella himalayanus** (Blyth).

The Himalayan Accentor is stated in the *New Fauna* (vol. ii, p. 192) to occur in Afghanistan. I can find no authority for the statement].

Prunella collaris rufilatus (Severtz.)

Specimen collected:—sex? 14 December 1884 Bala-Morghab (Aitcheson).

The only record of the Alpine Accentor in Afghanistan, though Whitehead says that it nests freely on the Safed Koh above 12,000 ft., eggs and young being found in July.

Prunella atrogularis lucens Portenko.

Specimens collected:—2 sex? Afghanistan (Griffith); ♂ 30 October, 1879 Kandahar (St. John).

These three specimens provide the only records of the Black-throated Accentor in Afghanistan.

Prunella fulvescens fulvescens (Severtzow).

Specimens collected.—♂ 9 April Paghman 8,000 ft., 17 April 1937 Ghorband 8,200 ft. (Meinertzhagen).

'Scarce. On 9 April we saw several which had arrived on a stony hill-slope where there had been none the day before. In the Ghorband Valley we saw only the specimen obtained. Probably only on passage.' (Meinertzhagen).

Prunella strophiatus sirotensis Koelz.

Specimens collected.—♂ 17 June ♀ 18 June 1937 Sirotai (Koelz).

The above specimens provide the only records of Jerdon's Accentor within Afghan boundaries and Mr. Koelz has separated them from the West Himalayan form under the above name (Proc. Biol. Soc., Washington, vol. 52 (5 June 1939), p. 67). The species must occur also on the western border as Whitehead found it (subspecies *jerdoni*) nesting fairly commonly on the Safed Koh between 9,000 ft. and 12,000 ft.

Muscicapa striata neumanni Poche.

Specimens collected.—♂ 20 May, ♀ 3 June 1879 Byan Khel (Wardlaw-Ramsay); ♀ 13 September, ♀ 21 September 1879 Kandahar (St. John); ♀ 20 April 1881 Kandahar (Swinhoe); ♀ 17 May 1885 between Chil-Gaz and Sim-Koh, Badghis (Aitcheson) ♂ 2 May Doshi 2,700 ft., 2 ♂ 1 ♀ 9 May Danaghori 2,300 ft., ♂ 23 May 1937 Dar-e-Shikari 6,800 ft. (Meinertzhagen).

Wardlaw-Ramsay found the Spotted Flycatcher to be a very abundant summer visitor to the Hariab Valley 7,000-8,000 ft. near Byan Khel, arriving about the middle of May and frequenting the valleys among the pine forests and the apricot orchards that border the streams. A nest with 4 fresh eggs was found at 8,000 ft. on 3 June. Meinertzhagen first met with the bird at Doshi on 2 May when a single bird was shot. He found it quite common in the gardens of Dana where it was without doubt nesting. Aitcheson's female, collected in Badghis on 17 May may also have been on its breeding ground.

At Kandahar, however, according to St. John the bird is a common passage migrant in the spring and autumn migrations.

Hemichelidon sibirica gulmergi Stuart Baker.

Specimen collected.—♂ 9-5-1879 Byan Khel (Wardlaw-Ramsay).

The Sooty Flycatcher is only recorded from the eastern boundary of Afghanistan where Wardlaw-Ramsay found it at 7,000 ft. in the valleys of the pine woods at Byan Khel. It was doubtless breeding as Whitehead says it nests commonly in the forests of the Safed Koh up to tree-limit.

Siphia parva parva (Bechstein).

Specimens collected.—♀ 1 April 1881, ♂ 31 March 1881, ♀ 6 April 1881 Kandahar (Swinhoe); 3 ♂ 23 March Gulran, 4 ♂ 12-19 April Tirphul, ♀ 1 May 1885 Kambas (Aitcheson); ♀ 29 April Chahar Shamba (Yate); ♂ 10 September Kabul, ♂ 22 October 1933 Sheikhabad (Maconachie); 2 ♂ 9-12 April Paghman 8,000 ft., ♂ 19 April 1937 Bamian 8,000 ft. (Meinertzhagen).

The typical race of Red-breasted Flycatcher evidently passes through Afghanistan on both migrations on its way to and from its winter quarters in India. The above records speak for themselves and Meinertzhagen says it was incredibly abundant at Bamian about 20 April—hundreds were seen but males in full plumage were distinctly uncommon—, their numbers dwindling on the 22nd and scarcely a single bird seen on the 24th. Two stragglers were seen in the Ghorband Valley on 24 May. At Kandahar it is common everywhere in suitable localities according to St. John.

Siphia parva albicilla (Pallas).

Specimens collected.—3 ♂ 1 ♀ 15-17 April Ghorband 6,500 ft. (Meinertzhagen).

These specimens furnish the only records of the eastern race of the Red-breasted Flycatcher. I have not seen them.

Alseonax ruficaudus (Swainson).

Specimens collected.—♀ 5 May, ♂ 9 May, ♂ 22 May Byan Khel, ♂ 19 June 1879 Sufed Koh 8,000 ft. (Wardlaw-Ramsay).

The Red-tailed Flycatcher is another Himalayan species which only reaches the eastern border of Afghanistan in the Hariab Valley about Byan Khel 7,000 ft. Here, according to Wardlaw-Ramsay it is one of the commonest birds extending up to nearly 11,000 ft. on the Safed Koh and being about the last bird which is found in any abundance where the pine-growth ceases. It was nest building in May. Whitehead also says that it is abundant in summer on the Peiwar Spur and in the Spin Khwar Nullah of the Safed Koh from 8,000 ft. to 11,000 ft.

Muscicapula superciliaris superciliaris Jerdon.

Specimen collected.—♀ 19 June 1879 Peiwar Kotal (Wardlaw-Ramsay).

The occurrence of this West Himalayan species, the White-browed Blue Flycatcher, in Afghanistan is only known from Wardlaw-Ramsay's statement that he came across a pair, and secured the male, on the Peiwar Kotal at about 8,000 ft. and Whitehead's corroboration that he too got one near the Peiwar Kotal and believed that he heard one or two more close by.

Tchitrea paradisi leucogaster (Swainson).

Specimens collected.—♂ 22 June 1879 Shaluzan (Wardlaw-Ramsay); ♂ 17 April ♀ 20 April 1881 Kandahar (Swinhoe); ♂ 30 April Logar 5,700 ft.,

♂ 22 September 1934 Ashraf Valley 4,200 ft. (Maconachie); ♀ 9 May Danaghori 2,300 ft., ♀ 24 May 1937 Ghorband 8,300 ft. (Meinertzhagen).

Meinertzhagen says that he only saw the Paradise Flycatcher at the village of Dana on 9 May, when two pairs were located, and in the Ghorband Valley when a single pair was nesting near the camp. All three males were in the red phase. It must of course be a summer visitor to Afghanistan and it probably only breeds in the north as Swinhoe expressly states that it is a straggler at Kandahar.

Meinertzhagen identified his specimens as *turkestanica* but I regard this as a synonym of *leucogaster.*

Lanius excubitor pallidirostris Cassin.

Specimens collected.—sex? Kandahar, ♂ 28 September 1879 40 miles N.-E. of Kandahar (St. John).

This is presumably the shrike, which under the name of *Lanius excubitor*, Hutton called very common round Kandahar and chiefly seen in winter. Both the above specimens are in the British Museum.

Lanius excubitor aucheri Bonaparte.

Specimen collected.—♂ 3 May 1885 Shore Kaltegai (Aitcheson).

This specimen also is in the British Museum.

Lanius minor (Gmelin).

Specimens collected.—♂ 14 April 1881 Kandahar (Swinhoe); ♂ Tirphul ♀ Khusan, both 25 April 1885 (Aitcheson); ♀ juv. 14 July 1933 Quila Ahinjaram 6,800 ft. (Maconachie); ♂ 5 May Danaghori 2,500 ft., ♂ 18 May Tash Kotal 4,000 ft., 2 ♂ 20 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

The Lesser Grey Shrike breeds in Northern Afghanistan but does not seem to be very numerous. Meinertzhagen first met with a pair at Danaghori on 5 May in small trees on the edge of the marshes. He has some interesting remarks on their larder. He goes on to say:—The Tash Kotal birds were among Pistachio trees and in their breeding quarters. A few were seen at Haibak but very wild. Fairly common and breeding at Kunduz at the end of May.

Status uncertain but I am inclined to suggest that it is a summer visitor and that Swinhoe's bird from Kandahar on 14 April was on passage.

Lanius vittatus Valenciennes.

Specimens collected.—2 ♂ 2 ♀ 6-17 April 1881 Kandahar (Swinhoe); ♂ 30 April 1885 Tirphul, ♂ 1 May 1885 Kambas (Aitcheson); ♀ 10 May 1896 Robat 4,300 ft. (Maynard); ♂ juv. 30 July 1933 Khinjan 3,500 ft. (Maconachie).

Wardlaw-Ramsay met with the Bay-backed Shrike in the Hariab Valley about Byan Khel 7,000 ft. on one or two occasions. Maconachie obtained a juvenile at Khinjan on 20 July and Aitcheson obtained specimens at Tirphul and Kambao in the north in April and May. St. John states that it is rather rare in Kandahar and Swinhoe's 4 specimens were all obtained in April. Maynard finally obtained a specimen in May at Robat 4,300 ft. These records suggest that this Shrike is merely a summer visitor in small numbers to Afghanistan.

Lanius cristatus phœnicuroides (Schalow).

Specimens collected.—2 ♀ 12-14 April 1881 Kandahar (Swinhoe); 2 ♂ 12 April 1885 Tirphul (Aitcheson); sex? 20 March Maruchak, sex? 27 March Khwaja Gogirdak, 2 sex? Darband-i-Kil Rekhta, one sex? Maruchak both 18 May (Yate); ♂ 22 April 1905 Kuhak (Cumming); 5 ♂ 1 ♀ 27-29 April Doab 5,000 ft., ♂ 1 May Barfak 3,500 ft. ♂ 6 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The status of this race of the Brown Shrike in Afghanistan is not very clear. It is no doubt a passage migrant through the country and most of the above records are consistent with this probability. Cumming's specimen from Kuhak was one of several found on 22 April on the banks of the Rud-i-Seistan.

It may, however, be also a summer visitor to Northern Afghanistan and Meinertzhagen says that everything pointed to birds commencing to nest at Doab and Danaghori though the fact was not recorded for certain.

Lanius isabellinus Hemprich & Ehrenberg.

Specimens collected.—sex? Afghanistan (Griffith); 2 ♀ 12-13 December 1880, ♂ 18 January 1881, ♂ ♀ 1-2 April 1881 Kandahar, ♀ 28 February 1881 Kokeran (Swinhoe); ♂ ♂ ♀ 7-13 March 1885, ♂ 18 March 1885 Panjdeh, ♂ 12 April

1885 Tirphul (Aitcheson); ♀ 28 March 1903 Kaod on the Asinki Canal (Cumming); 2 ♀ 1896, Mehrabnawar (Maynard); ♂ 6 March 1934 Chardeh-Kabul 5,700 ft., ♂ 19 March 1934 Chahiltan 5,900 ft. (Maconachie); ♂ 6 April 1937 Kabul 6,000 ft. (Meinertzhagen).

So far as is known the Isabelline Shrike is only a winter visitor to Afghanistan and the above specimens provide the only available information about it except for St. John's statement that it is common all over the Kandahar area.

Lanius schach erythronotus (Vigors).

Specimens collected.—♂ Khooner (Griffith): 2 ♂ 1 sex? 1879 Hariab Valley (Wardlaw-Ramsay); ♂ 2 January 1881, ♂ ♀ 6 April 1881 Kandahar (Swinhoe); ♂ 25 April 1933 Kabul 5,700 ft. (Maconachie); 3 ♂ 1 ♀ 22-24 April Bamian 8,500 ft., ♂ 2 May Doshi 2,750 ft., ♂ ♀ 7-8 May Danaghori 2,300 ft., ♂ 18 May Baghlan 2,000 ft., ♂ 20 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

The Rufous-backed Shrike is a summer visitor to north-east Afghanistan. According to Wardlaw-Ramsay it is very common in the Hariab Valley about Byan Khel 7,000 ft., where many nests were found in May and June, the first eggs being taken on 27 May. Maconachie notes of his Kabul specimen (25 April) that the bird was common and paired by that date. Meinertzhagen first noted it at Bamian on 22 April; three more arrived on the following day and on the 24th April a fair number were seen. By the 8th May they were abundant and breeding at Danaghori, keeping to the low-lying orchards and gardens and avoiding the hillsides. At Jalalabad, on the return journey, nearly fledged young were found. There is no record from any part of Afghanistan west of Bamian.

At Kandahar Hutton, Swinhoe and St. John found it very common, occurring in every garden and Swinhoe considered it to be a resident there.

Pericrocotus brevirostris brevirostris (Vigors).

Specimens collected.—♀ [April 1840] Otipore 7,000 ft. (Griffith); ♀ 16 May 1879 Byan Khel (Wardlaw-Ramsay).

Wardlaw-Ramsay found the Short-billed Minivet common in summer in the Hariab Valley and Whitehead found it nesting freely in the Safed Koh between 6,000 ft. and 8,000 ft. The Griffith specimen from Otipore (April) provides the only other record for Afghanistan.

[**Pericrocotus roseus roseus** (Vieillot).

I can find no authority for the statement in the *New Fauna* (vol. ii, p. 329) that the Rosy Minivet occurs in Afghanistan].

Dicrurus macrocercus albirictus (Hodgson).

Specimen collected.—♂ 31 May 1937 Jalalabad (Meinertzhagen).

The King Crow is confined to the eastern fringe of Afghanistan where it is probably a summer visitor only. Meinertzhagen saw it at the western entrance of the Khyber Pass in early April and in late May he found it as far west as 7 miles west of Nimla, that is 40 miles west of Jalalabad. They were certainly breeding in the Jalalabad gardens in the last week of May.

Griffith in his Journals (1840) mentions King Crows at Kooner 28 March Pashat 31 March, Chuqar Serai 6 April, Bharowal 14-15 April (several) and Gundamuck (6 June).

Wardlaw-Ramsay points out the fact that on the eastern side of the Peiwar Kotal the King Crow is extremely common right up to the base whereas to the west in the higher valley of the Hariab it is very scarce indeed. He apparently only saw a single bird at Byan Khel 7,000 ft. In his first paper he recorded it as *albicaudata* (sic) but in the second paper corrected this to *atra*.

Acrocephalus turdoides zarudnyi (Hartert).

Specimen collected.—♂ 20 April 1885 Tirphul (Aitcheson).

This specimen, now in the British Museum, provides the only record of the Great Reed-Warbler in Afghanistan.

(*To be continued.*)

FISH SURVEY OF HYDERABAD STATE.

Part III.—Fishes of the Medak District.

BY

M. RAHIMULLAH, D.SC., F.Z.S.,

Department of Fisheries, Hyderabad (Deccan).

(*Continued from p.* 91 *of Vol.* xliv, *No.* 1 (1943)).

Medak district (comprising of Medak, Kalabgur, Andol, Siddipet and Yellareddy taluqs besides Narasapur and Vikarabad (belonging to the Paigah)), lies between 17°25′ and 18°19′ N. and 77°48′ and 78°31′ E., with a total area of 3,198 sq. miles. It is bounded on the north-east and north by Karimnagar and Nizamabad; on the east and south by Atrafi-Balda district; and on the west by Bidar district and Paigah Estates.

There are numerous low hills; one range extends from Ramayapet in the north to the southern portion of Nizamabad, and then turning to the south again enters the district. Another range extends from the north-western corner to the east. The most important river is Manjra which runs through the district for about 60 miles. The Haldi or Pushpa and Aleru rivers are its main tributaries.

The rock formation is Archaean gneiss. Total population is 758,220 and that of the fisher-folk about 12,500. Tanks number about 3,000, and there are about 85 miles of canals; small anicuts or 'mathris' are 74 in number, one at Ghanpur about 10 miles from Medak town is quite big. From here two canals run from each flank of the Manjra and irrigate large tracts of land in Andol and Medak taluqs. Average rainfall is 33.4 inches and temperature 63°-96°.

Only a cursory survey of smaller tanks in Kalabgur, Siddipet and Andol taluqs was carried out, and important ones are mentioned below:—

Mahboobsagar is a fairly big tank near the old fort of Sangareddy town with a waterspread of about 2 sq. miles when full. It is fed by the Manjra during rains. The bottom is muddy and full of aquatic weeds which harbour many small shrimps and other crustaceans. As it is shallow, fishing is done intensively and very few fishes escape the nets of the fishermen. 'Murrals' are the principal food-fishes of this tank besides a few others as noted below:—

Notopterus notopterus (Pallas).
Mastacembelus armatus (Lacép.).
Chela clupeoides (Bl.).
Barbus (Puntius) sophore Ham.
Glossogobius giuris (Ham.).
Ophicephalus punctatus Bl.
Ambassis nama (Ham.).
Callichrous bimaculatus (Bl.).
Mystus tengara (Ham.).

Andol tank (waterspread 2½ sq. miles), *Posanipet tank*, *Annasagar* (waterspread 3 sq. miles) are within a few miles radius of Andol. All of them are shallow and dry up during summer. Only a few small fishes were obtained :—

Mastacembelus armatus (Lacép.).
Chela clupeoides (Bl.).
Rasbora daniconius (Ham.).
Barbus (*Puntius*) *dorsalis* (Jerdon).
Barbus (*Puntius*) *sophore* (Ham.).
Glossogobius giuris (Ham.).
Ophicephalus punctatus Bl.
Clarias batrachus Linn.

Medak town is almost surrounded by small and large tanks; near the town there are fairly big tanks. About 10 miles from the town is the Ghanpur anicut across the Manjra and from its southern flank the *Mahboob canal* starts; it is 27 miles long and irrigates 500 acres of land. It feeds directly or indirectly many tanks of which some important ones are: *Kistapooram*, *Railamadgu*, *Mambajpalli*, *Garwanpalli*, *Kanasanipalli*, *Devar Kosanipalli*, *Mutayapalli*, *Jakannapet*, *Nagaram* and *Sardana*. The canal finally falls into the Pocharam reservoir.

The other canal starting from the northern flank of the anicut is the *Fateh Canal* which irrigates about 400 acres of land in the Andol taluq and feeds *Chairypalli*, *Nagasanpalli*, *Unnawaram*, *Issipet*, *Kothapalli*, *Yellapuram*, *Poorstnipalli* and *Kurtial* tanks. The total length of this canal is about 22 miles.

The following is the list of a few selected fishes collected there:—

Mastacembelus armatus (Lacép.).
Chela clupeoides (Bl).
Barbus (*Puntius*) *sophore* Ham.
Catla catla C. & V.
Ambassis nama (Ham.).
Mystus cavasius (Ham.).

Fingerlings of *Labeo fimbriata* (Bl.), *Wallagonia attu* (Bl.), *Catla catla* C. & V., and many other fishes were collected in fairly large numbers from many of these tanks—they must have entered the canals from the river, and then along with the water have reached these tanks. These shallow tanks can thus easily serve as stocking centres from where the fingerlings of *Catla* and other fishes may be collected and then transported to other parts of the Dominions for stocking purposes.

The most important and the largest reservoir of the Medak district is the Pocharam reservoir (waterspread 6.2 sq. miles) formed by damming the river Aleru. It is situated in a very fine natural setting being surrounded by low hills which are covered with green vegetation during the rainy season, and during the winter months the lake teems with ducks and other aquatic birds which take shelter on small 'islands'. In short, it is one of the prettiest spots in the Hyderabad State and easily accessible to all lovers of nature. During the rainy season the lake overflows and is a magnificent sight to look at. At that time fishes are caught on the aprons and the overflow channels in large numbers; one catch of about 4 hours produced a bag of 60 fishes weighing approximately 350 lbs. At other seasons also the lake proper and its different channels were netted. Following is the list of fishes obtained:—

Notopterus notopterus (Pallas).
Notopterus osmanii Das & Rahimullah.
Mastacembelus armatus (Lacép.).
Chela clupeoides (Bl.).
Chela phulo (Ham.).
Rasbora buchanani Bl.
Rasbora daniconius (Ham.).
Aspidoparia morar (Ham.).
Barilius bakeri Day.
Barbus (Puntius) kolus Sykes.
Barbus (Puntius) sarana (Ham.).
Barbus (Puntius) sophore Ham.
Barbus (Puntius) stoliczkanus Day.
Cirrhina reba (Ham.).
Glossogobius giuris (Ham.).
Labeo boggut (Sykes).
Labeo calbasu (Ham.).
Labeo fimbriata (Bl.).
Labeo potail (Sykes).
Lepidocephalus guntea (Ham.).
Rohtee belangeri Cuv. & Val.
Rohtee cotio var. *cunma* Day.
Rohtee vigorsii Sykes.
Laubuca laubuca (Ham.).
Ophicephalus gachua (Ham.).
Ophicephalus marulius Ham.
Ambassis nama Day.
Ambassis ranga (Ham.).
Callichrous bimaculatus (Bl.).
Callichrous pabda (Ham.).
Mystus aor (Ham.).
Mystus armatus (Day).
Mystus seenghala (Sykes).
Proeutropiichthys taakree (Sykes).
Silonopangasius childrenii (Sykes).

The *Pocharam Canal* starts from here, and after running a course of 36 miles splits into many distributaries, two of which drain into the Nizamsagar reservoir and some finally flow into tanks after irrigating an area of 13,069 acres of land. During its course it passes through many tanks and indirectly feeds many others; the important ones are: *Muttumeda*, *Ramareddy*, *Nagareddy*, *Tadur*, *Jalalpur*, *Burgampalli*, *Yellareddy*, *Lingareddy* and *Bhawanipet* tanks.

Yellareddy tank, out of these, is the biggest having a waterspread of about 3 sq. miles, situated near the Yellareddy town. It is full of 'tunga' (*Typha elephantina* Roxb.) which is found in dense growth on the margins and in deeper portions, other vegetation is profuse. This tank is noted for its 'murral' which grow to a large size; this is the only place where I found 'murral nooze' in operation; large number of murral-fry are also caught and then sold for stocking purposes. The breeding season for 'murral', so far studied, is twice a year, viz., March-April and July-September. Fishes collected are as follows:—

Rasbora daniconius (Ham.).
Barbus (Puntius) amphibius (C.V.).
Barbus (Puntius) chola (Ham.).
Barbus (Puntius) sophore Ham.
Barbus (Puntius) ticto Ham.
Glossogobius giuris (Ham.).
Rohtee cotio var. *cunma* Day.
Ophicephalus gachua (Ham.).
Ophicephalus marulius Ham.
Ophicephalus punctatus Bl.
Ophicephalus striatus Bl.
Ambassis nama (Ham.).
Mystus tengara (Ham.).

Besides the tanks, a survey of the rivers Manjra, Haldi and Aleru was also carried out and a composite list is given below. The Manjra, the longest river of this district, enters near Jogipet and then after a run of about 60 miles falls into the Nizamsagar. The

Haldi joins it at a distance of about 3 miles from the Medak town and the Aleru about 10 miles up Nizamsagar. The beds of these rivers are rocky and only in parts, sandy. All of them are perennial but in summer they can be forded at places and in the tributaries a very shallow current of water remains, but during rains the amount of water is tremendous and the flow very rapid. The list of fishes is as follows:—

Notopterus notopterus (Pallas).
Notopterus osmanii Das & Rahimullah.
Mastacembelus armatus (Lacép.).
Mastacembelus pancalus (Ham.).
Rhynchobdella aculeata (Bl.).
Chela bacaila (Ham.).
Chela boopis (Day).
Chela clupeoides (Bl.).
Barilius bendelisis Ham.
Rasbora daniconius Ham.
Barbus (Puntius) dorsalis (Jerdon).
Barbus (Puntius) kolus Sykes.
Barbus (Puntius) sarana (Ham.).
Barbus (Puntius) sophore Ham.
Barbus (Puntius) ticto (Jerdon).
Barbus (tor) Khudree Sykes.
Barbus (tor) musullah Sykes.
Cirrhina reba Ham.
Gerra stenorhynchus (Jerdon).
Labeo bata (Ham.).
Labeo boggut Sykes.
Labeo calbasu (Ham.).
Labeo fimbriata (Bl.).
Labeo potail (Sykes).
Catla catla C. & V.
Esomus danricus (Ham.).
Amblypharyngodon mola (Ham.).
Glossogobius giuris (Ham.).
Thynnichthys sandkhol (Sykes).
Rohtee belangeri Cuv. & Val.
Rohtee cotio var *cunma* Day.
Rohtee neilli Day.
Rohtee vigorsii Sykes.
Lepidocephalus guntea (Ham.).
Nemachilus anguilla Annandale.
Nemachilus botia (Ham.).
Nemachilus denisonii Day.
Ophicephalus marulius Ham.
Ophicephalus striatus Bl.
Ambassis nama (Ham.).
Ambassis ranga (Ham.).
Callichrous bimaculatus (Bl.).
Rita hastata Val.
Rita pavimenta (Val.).
Clarias batrachus Linn.
Wallagonia attu (Bl.).
Mystus aor (Ham.).
Mystus seenghala (Sykes)
Mystus tengara (Ham.).
Mystus vittatus (Bl.).
Bagarius bagarius (Ham.).
Proeutropiichthys taakree (Sykes).
Silonopangasius childrenii (Sykes).

Some parts of the Manjra are excellent for angling, especially where water collects in deep pools, and the anicut at Ghanpoor also provides good sport. Some parts below the Pocharam reservoir are also very good angling spots where *Mystus aor* and *M. seenghala* take live bait easily. In the reservoir itself some 'islands' are also very good for this purpose.

Barbus (tor) khudree Sykes.

Barbus khudree, Sykes, *Trans. Zool. Soc. London, II*, p. 357.
Barbus khudree Sykes, Hora & Misra, *J.B.N.H.S.*, *40*, p. 24.
Barbus (tor) khudree Sykes, Hora, *Ibid*, *44*, p. 6.

In fin-formula it corresponds with that given by Hora and Misra but in colouration it differs a little.

Upper half of the body greyish black; lower half pinkish-white. Dorsal with greyish rays and margin; pectoral and anal yellowish-orange; ventral fringed with orange; caudal yellowish with grey fringe. Eye with yellowish-white margin.

It is locally known as *Kalimparka* and *Mansoor*,

Barbus (tor) musullah Sykes.

Barbus musullah Sykes, *Trans. Zool. Soc., London*, 1841, *II*, p. 356.

The Bawanny Mahseer, Thomas, *Rod in India*, 3rd Edition, pp. 22, 25.

Barbus (*tor*) *musullah* Sykes, Hora, *J.B.N.H.S.*, *44*, pp. 5, 6.

Colouration:

♂—Upper part of the body light-blue, lower lighter in colour. Dorsal, ventral and caudal blue; pectoral and anal yellowish-white.

♀—Body colour resembled that of the male but Dorsal fin was blackish-blue; pectoral and anal yellowish-white; ventral yellowish-pink and the caudal was bluish with orange fringe. These specimens were collected during the breeding season and were quite ripe. The fish is locally known as *Irraham*.

ACKNOWLEDGEMENTS.

I am indebted to Professors B. K. Das and M. Sayeeduddin and the Pro-Vice-Chancellor, Osmania University, for library facilities. To the P.W.D. and Irrigation Department I am grateful for other facilities, and to the Additional Revenue Secretary (Rural Reconstruction), H.E.H. the Nizam's Government, for encouragement and keen interest in this work. I am also thankful to my assistants and colleagues of this department for all the laboratory help which they extended to me always cheerfully and ungrudgingly.

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A NEW SPECIES OF CORDIA.

BY

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(*With a plate*).

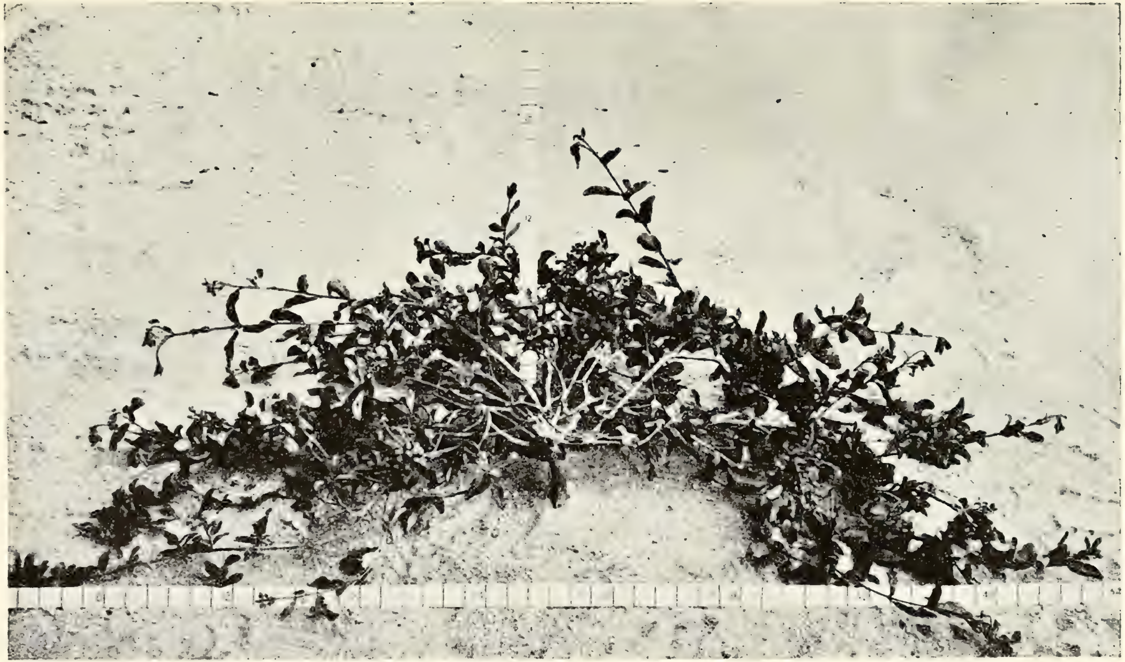
Cordia diffusa K. C. Jacob, sp. nov. Boraginaceae.

Ab aliis speciebus differt habitu fruticoso et diffundenti, foliis late ellypticis utraque superficie asperis setis coopertis.

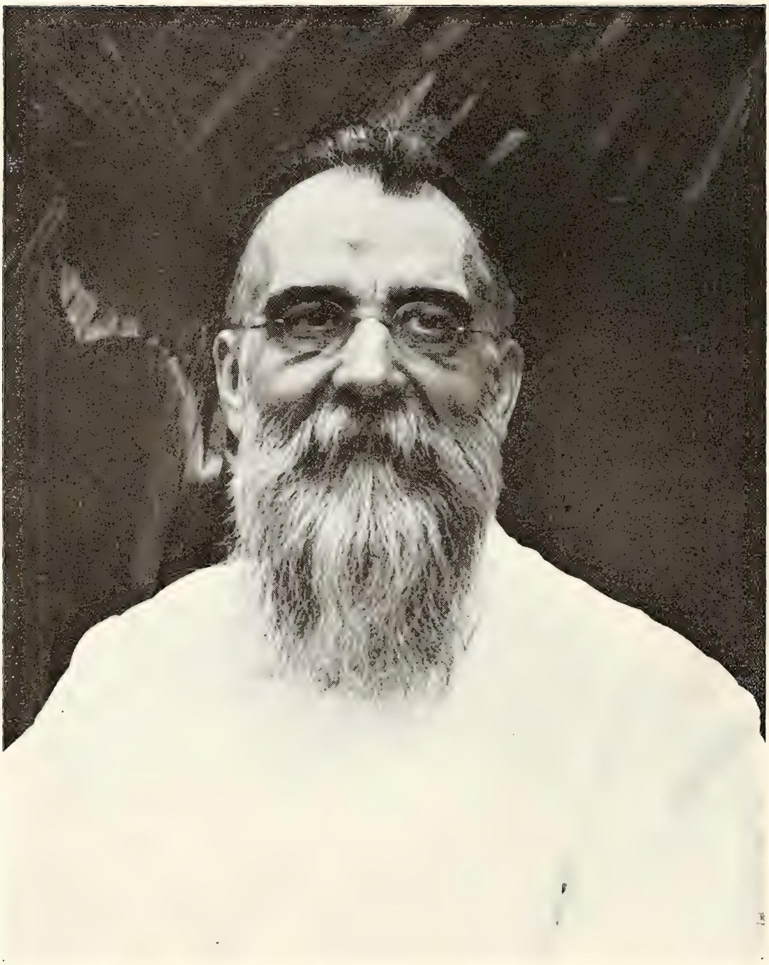
Fruticosa, diffundens, ramis ex stirpe orientibus; ramis ligneis, diffundentibus, 60-80 cm. longis et 5-7 cm. diametro; ramulis recentioribus setis asperis coopertis. Folia simplicia, alternantia, sub-opposita vel opposita, exstipulata, late ellyptica, obtusa, mucronata; lamina 4-5.5 cm. longa et 2.5-3.3 cm. lata, aliquando leviter major, crebro multo minor, utraque superficie asperis setis cooperta, aliquando cystolithis superiore superficie distincta; margine asperis setis obsesso, ad imam laminae partem integro, ad summam partem leviter serrato; venis prominentibus, 6-8 paribus, 4 vel 5 superioribus venis in mucronibus serrationum terminantibus; petiolo pubescenti, 3-5 cm. longo. Flores terminales, umbellatis cymis, potius congesti, 8-12 floribus; pedunculo simplici, 1.5-2 cm. longo, setis asperis obsesso; pediculo 2-4 mm. longo, ebracteato. Calyx tomentosus, brunneus, tubularis, 4-5 mm. longus, cum 3 dentibus. Corolla flavo-alba, tubularis, 7-8 mm. longa, 4-lobata, lobis prominentibus et reflexis. Stamina 4, exserta, sinibus tubi corollaris affixa; filamentis glabris, adnatis, apice liberis, parte libera 2 mm. longa; antheris 1 mm. longis, exsertis. Gynoecium 7-8 mm. longum, ovario 2 mm. longo, viridi, in stilum fastigante, 4-loculari cum unico ovo in unoquoque loculo; stilo 3 mm. longo, terminali, infro simplici, tunc 2-partito, partibus iterum 2-partitis et 1.5-2 mm. longis. Drupa ovato-acuta, mucronata, 1.5 cm. longa et 1.2 cm. lata, croceo colore; carne viscida; fulvo pubescenti, irregulariter lobato, persistenti poculoque simili calyci infixa; nucleo 4-loculari, 3 loculis sterilibus uno loculo cum unico semine. Semen 8 mm. longum, 6 mm. latum, infra rotundum, planis lateribus in apicem fastigans, apice foraminato. Fructus edulis.

Cordia diffusa K. C. Jacob, sp. nov. (Boraginaceae—Cordieae). It differs from the other species of *Cordia* in being shrubby and spreading with the leaves broadly elliptic and beset with rough hairs on both surfaces.

Shrubby, spreading, many branches from the root-stock; branches woody, spreading, 60-80 cm. long and 5-7 mm. across; young branches beset with rough hairs. Leaves simple, alternate, sub-opposite or opposite, ex-stipulate, broadly elliptic, obtuse at the apex, the apex ending in a mucro; lamina 4-5.5 cm. long and 2.5-3.3 cm. broad, some are slightly larger but many are much smaller, beset with rough hairs on both surfaces, sometimes in some older leaves upper surfaces dotted with cystoliths; margins beset with rough hairs, entire towards the base but slightly serrate towards the apex; nerves prominent, 6-8 pairs, 4-5 apical ones ending in mucros which form the serrations; petiole pubescent, 3-5 mm. long. Flowers terminal, in umbellate cymes, rather congested with 8-12 flowers; peduncle simple, 1.5-2 cm. long, beset with rough hairs; pedicel 2-4 mm. long, ebracteate. Calyx tomentose, brown, tubular, 4-5 mm. long, teeth 3. Corolla yellowish white, tubular, 7-8 mm. long, lobes 4, prominent and reflexed. Stamens 4, fixed at the sinuses of the corolla lobes, exserted. Filaments adnate to the base and free at the top, the free portion 2 mm. long, the filaments glabrous; anthers 1 mm. long, exserted; pistil 7-8 mm. long; ovary 2 mm. long, greenish, tapers to the style; style 3 mm. long, terminal, simple below, then 2-partite, the branches again bi-partite, 1.5-2 mm. long; stigma simple; ovary 4-celled; ovules solitary in each cell. Drupe ovate-acute, mucronate, 1.5 cm. long and 1.2 cm. broad, orange coloured with viscid pulp, seated on the cup-shaped, fulvous pubescent, veined, irregularly many lobed, persistent calyx; stone 4-celled, 3 of the cells barren and 1 one-seeded. Seed 8 mm. long, 6 mm. broad, rounded at the base with 4 flat sides tapering to apex with a hole at the top. Fruits edible.



Cordia diffusa, K. C. Jacob, sp. nov.



Father Jean Ferdinand Caius, s.j.

Type Locality : South India, Nanjundapuram, Coimbatore ; elevation 1,300 feet.
Type in Madras Herbarium, Coimbatore, Madras Herbarium No. 86237.
Collected by K. Cherian Jacob on 2-5-1938.
Local name : *Tam.* Siru or Nila Naruvili.

My thanks are due to Father A. Rapinat, S.J., Professor of Botany, St. Joseph's College, Trichinopoly, for kindly rendering the English description into Latin.

OBITUARY NOTICES

FATHER JEAN FERDINAND CAIUS, S.J.

Father J. F. Caius, S.J., died at Bombay on Thursday, July 27th 1944. Father Caius was one of that company of distinguished Jesuits, men of great learning and science, who devoted their lives to service in India and who, passing, have left this country richer for their labours and poorer for their loss. Born on January the 17th, 1877, in a country village in the district of le Medoc, France, young Caius had his early schooling at Toulouse, where his parents had settled. On completing his secondary education, Caius joined the Society of Jesus, and in 1895 came out to India as a scholastic. He joined the Madura Mission and was subsequently attached to St. Joseph's College, Trichinopoly, where among other things he started a Natural History Museum. His theological and other studies were completed partly at the Jesuit Seminary at Kurseong and then at St. Beunos College, St. Asaph, North Wales. He was ordained at Milltown Park, Dublin, on July 26th, 1908. Continuing his studies at Heeren Elderen, in Flanders and at the French house of Philosophy at Geemert in Holland, Fr. Caius realised the dream of his scientific hopes and training when he started his scientific researches at the School of Medicine of the University of Paris. In June 1911, Father Caius returned to India and was till 1922 Professor of Chemistry at St. Joseph's College, Trichinopoly, when he was transferred to Bombay to direct the Chemistry Department of St. Xavier's College. He had already established his reputation as a Bio-Chemist, and in 1924, he founded and was appointed by the Government of Bombay to take charge of the Pharmacological Laboratory of the Haffkine Institute, where he worked till his retirement at the age of 55, in 1932. He was a prominent member of the Indian Drug Enquiry Committee and made a substantial contribution to its findings. He was an active member of the Bombay Chemical Society, a member of the Faculty of Medicine of the Bombay University, a member of the Faculty of Arts and for many years an examiner in French at the B.A. and M.A. The French Government conferred on him the distinction of *Officier d'Académie* in 1929, *Officier de l'instruction publique* in 1936, and was for many years President of the *Cercle Litteraire* in Bombay, a popular member of the French Colony in Bombay. During the War he took a lively interest in the work of the Free French Committee : being an ardent patriot and de Gaullist.

It was my privilege in recent years to be intimately associated with him in some of his many activities. He was Chairman of the Committee of Trustees of the Natural History Section of the Prince of Wales Museum. He was also the Honorary Secretary of the Bombay Natural History Society and one of the editors of its Journal. It was good to work with him. He brought to his work the acumen, the clarity of thought, the critical mind of the true man of science that he was. But he also brought to it that human sympathy and understanding which endeared him to all who worked with him. In the field of Science he was unable to suffer fools gladly. But in the field of human charity his great heart got the better of him. For this will he be loved and remembered by us. One of the things he liked doing best was editing the Journal of the Society. The last proofs he corrected for us he corrected on his deathbed. He sent them to me on the morning before he died. They were done with the same care and precision as any he had done before. A few hours before his death he wrote a criticism of a thesis submitted by one of his students for the Bombay University. It was truly a triumph of mind over bodily affliction. And that I think was his life for many years. The ceaseless struggle of a brave spirit which would not yield to failing health and strength. One is glad to feel and know that his work with the Natural History Society brought him some measure of happiness during his closing years. Whatever the state of his health, he came plodding up the stairway and sat down to his work. There was always a smile, a joke, some trenchant humour. He went away cheered. He felt he was doing something. He was no dilletante of science. He was a man of action. He wanted to serve, to use his knowledge. He felt that it was being wasted. It was indeed wasted by the State who might well have continued to use his great knowledge to the greater good of this country and its people. His untimely retirement from his post as Director of the Pharmacological Laboratory of the Haffkine Institute was to him a grevious disappointment. It was a premature cutting off from a field of endeavour in which he had accomplished much and in which he knew he could accomplish more. As a realist, applied science attracted him more than the realms of pure research. His chosen field was science applied to the alleviation of human suffering. In the Haffkine Institute he carried out intensive investigations into the therapeutic value of various remedies employed to combat diseases caused by hookworms and round worms—diseases so prevalent in India. The results of his researches were published in the Indian Journal of Medical Research. His work has been accepted as the most exhaustive and complete treatise on the subject. It is repeatedly quoted by most text books on pharmacology. Another contribution by Father Caius was his extensive studies of the poison apparatus of snakes and of the remedies employed against snake poisons. Quite early he collaborated with Dr. Marie Phisalix, the distinguished savant and herpetologist of the Paris Museum. Their combined reseaches into the structure and function of the poison apparatus of snakes, particularly of species generally believed to be non-poisonous, were published in the Journal of Physiology and Pathology of Paris. Here in India Caius turned his attention to the investigation of the value of various remedies supposed to be effective against snake bite. He searched Ayurvedic and Unani systems of medicine to find out if any effective cures could be found. It was long and laborious research. He found none that were effective, but he and his collaborators rendered a great public service by showing that these so-called and widely employed remedies were completely without action against Cobra or Viper venoms. He also made valuable contributions to our knowledge of methods of concentration of antivenine, and he was one of the pioneers in undertaking investigations into the chemo-therapy of plague. He was one of the leading authorities on the Medicinal and Poisonous Plants of India. Students of indigenous drugs will ever be indebted to Father Caius for his revision of Kirtikar and Basu's work on Indian Medicinal Plants. This book published in 4 volumes is now the standard work on the subject. It classifies the various drugs used in indigenous systems of medicine and provides a wealth of information of their action and uses. As with all his writings, they are marked with an objectivity, a clarity of thought and conciseness which have earned the admiration of scientists and laymen. He also contributed a series of articles on the Medicinal and Poisonous Plants of India to the Journal of the Bombay Natural History Society and to the *New Review* of Calcutta.. Another subject which interested him was the question of 'Earth-eating and Salt-licks'. His analysis of 'Salt-licks' sent from various parts of India were published in the Society's Journal. This was the measure of his services to the country as a scientist. But what of Caius the man? None of us who knew him intimately will forget him. To some he might have seemed elusive and forbidding; but under that somewhat stern exterior there beat a great heart, a heart full of charity and kindliness to the poor and suffering, full of compassion for the lowly. To the least of these he was a father and friend. He died as he lived, working for his fellowmen. It is the best epitaph that could be written of a man. May God rest his soul.

S. H. P.

SIR ERNEST HOTSON, K.C.S.I., O.B.E.

In the death of Sir Ernest Hotson on May 12th 1944, the Society loses one who has been for many years one of its strongest supporters. John Ernest Buttery Hotson was born on March 17th 1877. He was educated at Edinburgh Academy and at Magdalen College, Oxford.

He was in the Indian Civil Service from 1899 but when the last War broke out he joined the Indian Army Reserve of Officers and was on military duty chiefly in Baluchistan from 1915 to 1918, was Lt.-Colonel in command of the Mekran Levy Corps and subsequently was appointed Consul at Shiraz, Persia.

Sir Ernest was a keen naturalist and when he was in Baluchistan and also in Persia, he collected specimens for the Mammal Survey of India which was started by the Bombay Natural History Society.

In the Journal of the Society, Vol. xxvi, the late Mr. Oldfield Thomas published an article on 'Some new Mammals from Baluchistan and North-West India' and named two new species after Col. Hotson :—Hotson's Jerboa (*Allactaga hotsoni*) and a new Vesper Mouse (*Calomyscus hotsoni*).

This was followed by an article in Vol. xxvii. by Major R. E. Cheesman on a Collection of Mammals made by Col. J. E. B. Hotson in Shiraz, Persia, and two of the Bats were found to be new to science.

Another small collection of mammals was acknowledged from Colonel Hotson in the same Volume. These were part of a collection which was looted on the way down from Shiraz and were discovered lying at the bottom of a well, the remainder, comprising chiefly botanical specimens, were unfortunately destroyed.

Mr. R. I. Pocock of the British Museum (Natural History) has kindly supplied the following notes in regard to specimens collected by Col. Hotson which have passed through his hands :—

1. Adult female and half-grown kitten of *Felis lybica nesteron,* a race of the Desert Cat (*ornata*), new to the British Museum Collection, from Persepolis (Mamm. Brit. India, Vol. I, p. 288).
2. An interesting specimen of the typical race of the Jungle Cat (*Felis chaus chaus* from 9 miles South of Shiraz (op. cit., p. 292).
3. Specimens of the western race of the Common Mongoose (*Herpestes edwardsii ferrugeus*) from Qasrquand on the Perso-Baluchi border and from Shiraz (Vol. II, p. 17).
4. Specimens of the small race of the Indian Wolf (*Canis lupus pallipes*) from Kajdar, S. Baluchistan (Vol. II, p. 91).
5. Several specimens of the western race of the jackal (*Canis aureus aureus*) from Shiraz and several localities in Baluchistan (Vol. II, p. 97).
6. White-footed Fox (*Vulpes vulpes pusilla*), many specimens from various localities in southern Baluchistan, from Chanaban in the Persian Gulf and Shiraz, the specimen from the last locality being a topotype of Blanford's *persica* and helping to show that that name is a synonymy of *pusilla* (Vol. II, p. 12).

The ungulates have not yet been reported upon.

Persian Gazelle (*Gazella subgutturosa*), Shiraz.

Ibex and Ooorial from S. Baluchistan. The Ooorial being a particularly interesting lot showing seasonal changes etc. and throwing a good deal of light upon the synonymy of this sheep in Western India.

'All his skins were valuable because they had full particulars, localities, altitudes, dates and measurements. I do not believe that Oorial, for example, have ever been properly measured before, sportsmen caring for nothing but the horns and shoulder height.'

These notes by Mr. Pocock demonstrate the exceptional value of Sir Ernest Hotson's collections, given to the National Collection, through the Bombay Natural History Society.

Sir Ernest very generously defrayed half the expenses of the collector, Mr. Baptista, who joined him in Baluchistan and also in Shiraz.

A large collection of botanical specimens made by him in Baluchistan, Afghanistan and Persia, was presented by Sir Ernest to the late Fr. E. Blatter, S.J., and is now in the Herbarium of St. Xavier's College, Bombay.

Returning to Bombay after the War, he again served at headquarters as Secretary in the Political Department from 1922, and then as Chief Secretary. In 1926 he was appointed to the Governor's Executive Council and when Sir Frederick Sykes went home on four months' leave, Sir Ernest acted as Governor of Bombay.

W. S. M.

MISCELLANEOUS NOTES

1.—A NOTE ON THE HABITS OF PIKAS OR MOUSE-HARES.

The pikas are said to be found in Kabul[1], but the writer has had little chance to find them in the city. They are, however, found in abundance at Surchashma (a small village about sixty miles south-west of Kabul) and at the Unai Pass, both places being situated at the source of the Kabul river. The Unai hills are about eleven hundred feet high, and one of their valleys, situated two miles of Surchashma, called Durra-a-bagha, is probably the central habitation of pikas in this area.

The pika of Surchashma belongs to the species *Ochotona rufescens* (Gray) and are locally known as *Mush-a-lundae* (tail-less rats) or *Khalta-mush* (sac-like rats). They are gregarious and eagerly eat the fresh plants of wheat and lucerne and so prove a menace to cultivation. The weasel is said to capture and devour them and hence is often kept by the cultivators. They live in crevices of loose stones in the low bounding walls of cultivated land, formed in terraces on the lower slopes of the hills. These slow moving small animals come out early in the morning and evening and children capture them from their holes by taking hold of their ears. Thirty pikas were caught by the writer last year, but only one, the strongest and healthiest, was able to endure captivity for forty days. The natural diet is evidently the fresh leaves of wheat and lucerne, but they were given wheat grains and mostly carrots. In the meantime the colour of the fur faded, i.e., turned into pale brown, which may, probably, be due to diet or their being kept in shade.

FACULTY OF MEDICINE, S. A. AKHTAR.
KABUL,
January 15, 1944

[Desert Gerbilles (*Meriones hurrianae*) from the Sind Desert became perceptibly darker after 6-8 months captivity in Bombay. Diet or light and climatic change may have been the cause.—EDS.]

2.—THE HIMALAYAN TAHR (*HEMITRAGUS JEMLAHICUS* H. SIM.) IN SIKKIM.

Captain Wrenicke's very interesting note on the Tahr in Sikkim draws attention to a little known fact of distribution. The existence of Tahr in Sikkim has been known for many years. In the *Fauna of British India*, Mammalia, Blanford states that this animal occurs 'throughout the Himalayas from the Pir Panjal to Sikkim' and adds '(I have skins from the latter, obtained by Mr. Mandelli).' A skull and, I think, a skin is preserved in the Natural History Museum at Darjeeling.

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[1] *Jour. Bomb. Nat. His. Soc.*, Vol. xxvi, 4. p. 937.

Just before the war a German named Schaeffer was travelling in Tibet and Sikkim. He obtained specimens of Tahr which were named *schaefferi* by a German zoologist. Owing to the war, the description of this, as a new species (or sub-species?), is not obtainable in this country.

In the Sikkim shooting licence, the Tahr was deliberately omitted from the list of game which might be shot, as it was not intended to allow any to be killed on a normal shooting trip. The licence did not include a complete list of game animals to be found in Sikkim.

HILL HOUSE, NORTHREPPS, F. M. BAILEY,
CROMER, NORFOLK, ENGLAND, *Lt.-Col.*
November 29, 1943.

3.—CANINE TEETH IN CHITAL (*AXIS AXIS*) STAGS.

On page 169 of the Society's *Journal* for December, 1943 (vol. xliv, No. 2), Pocock states that in Axis deer, generally known as the chital in India and as the spotted deer in Ceylon, the upper canine teeth are typically absent—in both sexes.

Pocock quotes Lydekker as saying, on unstated authority, that the canine teeth are generally absent in Axis, a contention which was repeated or copied by Phillips. Pocock found that the canine teeth were 'entirely absent' in all the numerous skulls he examined at the British Museum.

I have not got my reference—nor Game Book with me, but I wonder if your readers who have shot the lovely Axis stag will agree with these rather general statements.

Many times I have been surprised to find that big game hunters had never heard of these well-known teeth in stags, the *haken* as German and Austrian stalkers call them—much prized trophies when mounted acorn-fashion in badges and brooches.

I have pointed out these rudimentary teeth in Axis stags more than once to friends in the field, and somewhere in my collections there must be a few sets but it is not possible to post them to you at the moment.

No doubt these teeth, as found in Axis, can only be called rudimentary, they are not solid and fully developed as in the stags of Europe. As a rule they are just under the skin of the upper gums and have not broken through. In a few cases they are visible as small white spots.

They can be lifted out quite easily and rather resemble the thin broken shell of a tiny egg. It is not surprising that the skulls in the British Museum should not show any of these teeth as they are lost at once when the flesh has rotted or the skull has been boiled and cleaned. There is no socket. The skull of the European stag does not show these teeth, although the animal grows fully developed and solid ones.

Strange to say many trackers—as a rule keen observers—rarely know about this and are interested when shown them.

Is Pocock correct in saying 'absent in *both* sexes'? I have never heard of these 'haken' having been taken from a hind.

Pocock's observations are I think often rather general. It is no criterion (page 173) to think that the Axis skull in the Ceylon deer is noticeably smaller than the skull of the Indian specimens. Pocock had only two ♂ skulls from Ceylon for study, both said to have been collected near Cheddikulam. It would be more correct to get a good series from the south-eastern regions, where the best type of Axis deer is found, and with which the North Ceylon spotted deer—of very poor physique due to feeding, continual harassing and disturbing, poaching, etc.—cannot bear comparison. It is not possible to arrive at any correct data from only two skulls picked up anyhow in the Island.

It is by no means clear why there should be the sub-specific name *ceylonensis,* merely because the Ceylon spotted deer, as a rule, is a poorer beast which grows a poorer head than his Indian brother. The slight differences in colour of coat (for which many reasons could be given), body pattern, etc., are of too small significance to warrant another sub-species being added to the already numerous—and often doubtful so called sub-species which scientists worry about and burden us with.

I agree with Pocock (page 172) where he says that the sub-specific status of *ceylonensis* is hardly permissible.

COLOMBO, CEYLON, A. C. TUTEIN NOLTHENIUS, F.Z.S.
BOX 15,
February 4, 1944.

4.—'BURIAL GROUND' OF ELEPHANTS

A legendary belief.

In the *Royal Natural History,* edited by Richard Lydekker, I came across the following passage about the Indian Elephant:

'A curious circumstance in connection with these animals is, that the bones of those which have died a natural death are scarcely ever found in the forests of India, and we believe that the same is true with regard to Africa. It has accordingly been suggested that elephants are in the habit of resorting to particular spots when about to die, as is known to be the case with the guanaco in South America. . . . . , but as no such mortuaries have ever been discovered in India, this seems scarcely tenable, and the subject accordingly still remains a complete mystery'.

As the above passage was written as long ago as the year 1894 I think this mystery must have since been solved and I shall be obliged for information on the subject. I have no other book for reference on the subject.

As regards the habit of resorting to dying places I shall be glad to know your opinion on the subject as to the reason of this interesting habit. Guanacos of the Llama family in South America have been known to have their dying places where they go when wounded or when they feel their end near. Referring to these places Darwin, as quoted by the same author, says, 'on the banks of the Santa Cruz . . . always near the river the ground was actually white with bones. . . . The animals in most cases must have crawled before dying beneath and amongst the bushes'. Mr. W. H. Hudson also, as quoted by the same author, has attempted to solve this mystery of guanacos resorting to dying places before their death. According to his opinion this habit is due to an inherited instinct, derived from a time when the animals were accustomed during a period of exceptional cold to seek refuge beneath the cover of bushes growing in the sheltered river-valleys. 'Once we accept this explanation as probable,' writes Mr. Hudson, 'namely, that the guanaco in withdrawing from the herd to drop down and die in the ancient dying-ground, is in reality only seeking an historically-remembered place of refuge, and not of death—the action of the animal loses much of its mysterious character; we come on the firm ground, and find that we are no longer considering an instinct absolutely unique, with no action or instinct in any other animal leading up to or suggesting any family likeness to it.'

I am tempted to quote the above passages as I found them interesting. I am inclined to believe this solution of the mystery of guanacos resorting to dying places and the same solution must apply to the African elephant. As to the habit of the Indian elephant I invite information from you. Please also let me know if the African elephants have really such habit. If we accept Mr. Hudson's solution the question arises as to why other animals lost their inherited instinct of resorting to their ancient place of refuge when they feel their death is approaching, or is this mystery a complete myth?

PORBANDER, V. M. VASU.
KATHIAWAR,
April 4, 1944.

[Hudson, in his preliminary remarks to the passage quoted above observes that this strange habit is only developed among the guanacos of Southern Patagonia and nowhere else within the wide range of the species. African and Indian elephants are the only other animals credited with the same habit. There is no evidence to support the belief.

As indicated by Mr. F. W. Champion (Wild Elephants of the United Provinces—*Journal*, *B. N. H. S.*, Vol. xxx, p. 132) the legend about wild elephants resorting to some common and secret place in which to die has no foundation in fact. The life span of an elephant is long and their customary habitats lie in sparsely populated districts. Occasion and opportunity for discovery of an occasional corpse in immense tracts of forest is infrequent. Besides the carcase of even so large an animal may be practically disposed off within a brief period—eaten by innumerable animals, habitual scavengers and others, and the remnants covered over by rank grass and vegetation of the monsoon. Records of the discovery of carcases of elephants which have died of old age, though scanty, have been noted—Mr. Champion records one (*Journal,* Vol. xxxiii, p. 433).—EDS.]

5.—THE WINTER FOODS OF BIRDS IN KASHMIR.

Careful observation from September till March have shown how certain birds live and how certain birds confine themselves to relatively restricted diets.

The following are the commonest foods: rice, plentiful in all rice fields which are fallow and mostly dry and hard during the winter until snow comes—especially plentiful when small stacks have been made before the sheaves are carried to the villages for threshing.

Pulse (*Moong Dhal*), buckwheat and the seeds of various weeds that grow in maize fields—a little wheat from the June harvest and a sort of Canary seed.

The seed of a tall grass that grows plentifully on the lower slopes and amongst scrub and where pine trees are not too thick. This grass is not eaten by animals except the heads, when the seeds are ripe. Its seeds are about ¾ of an inch long, very sharp at each end. It is said that in a great famine human beings harvested the seeds and made flour of them. Wheat when being sown during the winter; the seeds of pine trees chiefly *Pinus longifolia*. The leaves of a small shrub, and when the snow is thick, green moss off rocks.

Having regard to the fact that there is rice lying everywhere in the fields it might be imagined that it would be the first favourite but this is not so. *Koulan* (Demoiselle crane) feed largely on rice and at the same time dig up field mice.

Geese leave the sanctuaries and some years feed in the dry rice fields with their heads down, in other years you see practically no geese doing this. It is noteworthy that it is practically impossible to stalk *Koulan* in the fields because of their height combined with their constant vigilance. Geese on the other hand are so busy eating that it is often possible to get close to them, especially to small family parties as opposed to big flocks of 100 or more.

Crows in large flocks get their living in any rice fields for several months. They spend the day in comparatively small flocks, which, just as it is getting dark, collect in the big Chenar trees of villages and then go on to big trees at certain points, when the amalgamation of these units produces enormous flocks that set out to their roosting places in willow copses. They choose young plantations, possibly protected by higher ones from the prevailing wind. An examination of the surface under the crows' roosting places reveals that the ground is thickly covered with droppings in which there is a large proportion of undigested rice grains. Local people will not eat these crows but may eat the kind with 'orange beaks and claws' i.e. Choughs. It was noted that in the Gurdaspur *jheels* of the Punjab in the winter of 1942-43, fishermen made a business of catching crows that came to roost in the high reeds using very light fragile nets on light poles. The birds when disturbed at night fly low along the channels used by boats through the high cover. It was customary to send at least part of the catch to towns for sale. The feeding habits of chukor are the same, and are interesting and vary according to habits of different coveys.

In September and October some chukor, but only a small proportion, come down to the fields as the crops are cut, but soon move up the hills again. It seems that they rely as far as possible on the seeds of the tall grass aforementioned, preferring to pick the seeds off the stalks, especially when knocked down by the passage of herds of sheep and goats. Besides the seeds, they eat the leaves of a small wiry shrub, until they fall in the autumn. By far the greater proportion of chukor rely for their main winter food on the seeds of *Pinus longifolia*, and when the snow comes they still stay, because the seeds are easily visible where they fall from the wet cones on to the snow.

Chukor which live on pine seeds will come downhill a matter of a thousand feet once a day to water, to feed in cultivation, or go to places where they can have a dust bath. Coveys that do this are distinct from those, which for some reason live lower down and do not favour pine seeds. Wheat is undoubtedly the favourite food of chukors—so long as the ground is dry and soft—they will risk anything to get to fields up to the time the grain is well germinated. It has been noted that a great many birds, including ducks and geese, gorge on freshly germinated seeds that sprout in the first winter rains such as the Tre-foil Bur in India—various desert seeds in Iraq, and Persia. This is presumably a craving for vitamins.

It is highly probable that the hill pheasants, like the chukor feed largely on pine seeds for at least part of the year.

One interesting point is that chukors do not seem to be interested in rice as a diet, and do not in consequence come down to rice fields. They have been seen in ground well below rice fields, but no rice has so far been found in the crop of a chukor. This is strange—we know the black partridge is very fond of rice. Is it that the chukor has not a sufficiently good digestion to cope with rice? It has been seen that the crow certainly passes a lot of it whole. Ducks and geese are particularly fond of rice and go long distances to fields where the crop has been devastated by a flood and left unharvested.

In some places very large flocks of pigeons come down from caves in cliff faces and feed in the dry rice fields, often mixed up with the crows so that there are good grounds for the story of the person who shot at a pigeon and killed a crow.

The flight of crows to and from their roosting places is interesting in that they seem to work to a timed plan as regards gradually forming up into enormous flocks, that appear in the failing evening light like a huge piece of chiffon being waved in the sky. A similar sight is the flight of starlings in Iraq to roosting places in the reeds in the marshes. In the Kangra valley the crows ascend in spirals, apparently by gliding at certain fixed points to their roosting places in copses on the face of the Daula Dar Range. It is curious that they should start to go to bed relatively early in the afternoon presumably to make use of radiation in their upward gliding and also to get the sun as long as possible where they roost. Is it a matter of habit that makes them go from, say, 3,000 feet to 7,000 to roost where snow is on the ground at the latter height? The downward flight of crows to their feeding ground is a delightful sight, sometimes by single birds droppnig at a steep angle and at other times by the birds of a big flight suddenly breaking their formation and losing height by a series of fantastic dives at a great speed and in all directions accompanied by a loud noise from the impact of air in their feathers.

C/O GRINDLAY & CO.,
BOMBAY.
January, 1944.

G. DE LA P. BERESFORD,
Major-General.

6.—BIRDS OF BOMBAY.

I read with interest in your issue of December 1942, the note by the Bishop of Bombay on the birds of his Malabar Hill garden in Bombay (Vol. xliii, No. 3, p. 525). If space permits, I should like to add some complementary observations on the birds of a very different habitat, situated some three miles away on the opposite side of Back Bay. I refer to the area of open common land and tidal mudflat known as the Colaba Reclamation, now alas owing to wartime exigencies, becoming an increasingly built-up area.

During the months of August, September and November, 1943, this small oasis of nature afforded me many an evening's happy hunting with a pair of binoculars. My reference bible has been Sálim Ali and H. Abdulali's 'Birds of Bombay and Salsette', an invaluable working basis, which I shall hereafter refer to as 'BBS'. These notes are submitted as a further contribution to the facts and figures there recorded.

The half-reclaimed basins of tidal mudflat are first and foremost a refuge and feeding ground for a large assembly of waders, most of which arrived and either settled in or passed through during the period under review. First species to claim mention is the Common Sandpiper. Previous observation in nearly every month of the year confirms that its status is certainly that of resident, though persumably non-breeding. One or more were to be seen on every visit, usually away from the motley throng for the Sandpiper is an individualist who is not confined to the crowded mudflat. In the first half of August the only other true waders seen were a small party, which I doubtfully identified as Grey Plover; they only appeared once. On August 21, the scene had become transformed from one of damp desolation to one of feverish activity, and on August 25, a rough count yielded 180 Sand Plover, 15 Stint, 8 Redshank, 8 Whimbrel, 7 Dunlin, 6 Turnstone, and 2 Greenshank. It was a pleasant surprise to recognise so many old friends often watched in the U.K. It will be noted that the arrival date of Stint is a month ahead of September 25, given as the earliest date in BBS. By the beginning of September, the Stint were as numerous as the Sand Plover and, as far as could be seen, were all *Erolia minuta*; no Temminck's have yet been noted. Dunlin, though noted in BBS as 'uncommon' also became as numerous as the Sand Plover by September 7. The Sand Plover was a new species to me, and as I failed to detect variations in size or plumage with any certainty I presume my notes must refer only to the Pamirs Lesser Sand Plover. They were first observed on August 21, as compared with September 13, given as earliest date in BBS. Throughout September and November (I was away during October) the above three species remained the principal clientele of the mudflats, feeding in mixed flocks of several hundreds.

The Redshank and Greenshank,—the latter easily spotted at long range by his practice of feeding apart, probing his recurved bill from side to side with a scythe-like motion—have remained fairly constant in numbers, the largest total being 15 Redshank and 4 Greenshank recorded on November 22. In view of the scant records of the occurrence of Turnstone (none since 1875 according to BBS), it is of particular interest that about a dozen were first observed on August 21, and subsequently an average of 6 have nearly always been present. I have frequently watched them at close quarters, sometimes scattered in mixed flocks, sometimes feeding in one compact party. On September 14, I was surprised by the odd behaviour of one individual who was running about among the coarse grass and pebbles beside the sea wall busily turning over the latter and quite oblivious of my presence as I stood watching only 3 paces away.

Of all waders the wary Whimbrel was the most unapproachable, and his presence was often only betrayed by his piping titterel or a glimpse of his strong twisting flight as he disappeared into the dusk. He has remained a constant visitor to the mudflats since first noted on August 25.

On September 2, I observed a solitary Golden Plover in full summer plumage. On September 15, 40-50 had arrived, some in summer, some in winter plumage. They were still present up to the end of November, but fluctuated considerably in numbers from as many as 100 on some days to none at all on others. They are wild and wary creatures, especially when in a large flock, and at times they seemed to infect the other waders with their nervousness. On November 4, I again suspected the presence of Grey Plover, but bad light prevented confirmation. On September 4, I had the pleasure of recognising for the first time a Black-winged Stilt,—BBS gives earliest date as September 29. On September 13 there were two and I found them very easy to approach. By the 29th they had gone; perhaps the slackening of the monsoon had left the mud no longer deep or soft enough for their liking.

So much for the waders. One other transient visitor worthy of mention was a party of 22 duck which appeared on September 12 and was present in dwindling numbers till the end of the month. They nervously kept well out in the middle and I could only doubtfully identify them as Gadwall. The Herons and Egrets have been constantly represented by the ubiquitous Paddy Bird (up to 20 at a time), by Cattle Egrets, Reef Herons, both white and slaty-grey, one or two solitary Grey Herons, and by possibly the Purple Heron.

I would like now to mention briefly some of the other more interesting visitors to the Reclamation. I will not attempt to list all of the 60 odd species so far noted, as such a list not covering a whole season would. necessarily be very incomplete. Two or three Desert Wheatears were first observed on November 14 along the sea wall (BBS gives November 12 as earliest date). A Rufous-backed Shrike has taken up his stance on the waste land and was first noted on September 29; a Wood Shrike has once been seen. Whitethroats which had probably arrived in October were observed singing their fidgety little song on November 10. A party of Brahminy Mynas put in an appearance at the end of the month. Pairs and small parties of White-throated Munias have been seen periodically and on October 5, they were in company with several Red Munia (escapes?). A Yellow-throated Sparrow was seen on the same date.

The first of the wagtails appeared on September 12, a *Motacilla flava* (subsp.?). The first White Wagtail was seen on October 5, three days after earliest date given in BBS, and during November they had become the commonest of the wagtails. A solitary handsome roller seemed to have taken up his winter quarters, and was first seen on October 5; several Hoopoes had done the same, the first being noted on September 18 which is earlier than the BBS date October 12. The first bee-eaters to arrive were the blue-tailed species (Blue-checked?—Eds.). They were first seen on Sept. 19, and quite a large number were observed up to October 5; on my return at the beginning of November, all had disappeared and their place was taken by numerous Common Bee-eaters whose advance guard had appeared on October 2. The White-fronted Kingfisher and the common Indian Kingfisher have both been seen at other times of the year on the Reclamation and deserve mention if only for their attractive finery.

Concerning hawks and their like, a solitary Kestrel was seen on November 14 and two days previously I had had a close view of a White-eyed Buzzard-Eagle, who may have come to stay as he was seen several times up to December 4, when I left Bombay. Apart from Kites—and the Brahminy has been seldom observed—the one other constant visitor has been a fine specimen of a Harrier. After a number of close views I have identified him with reasonable certainty as an immature Pale Harrier, the ruff being more distinct than in the very similar Montagu's. Since his first appearance on September 29, I have watched him many times harrying up and down his chosen beat with that characteristic easy grace and poise which is such a pleasure to behold.

R.A. Mess, R. K. MARTIN,
Bombay. *Lieut.*
January 20, 1944.

[The authors of BBS would welcome bird notes from Bombay and Salsette, especially relating to seasonal annual migratory movements, nesting (where unrecorded), ecology etc. The notes are not intended for publication in the *Journal* but for use in the 2nd revised edition of BBS now under preparation.—Eds.]

7.—SOME NOTES ON THE MOVEMENT OF BIRDS IN THE LOVEDALE NEIGHBOURHOOD—NILGIRIS.

This winter (1943-4) migration appears to have been rather later than usual. Perhaps this was due to the particularly bad weather conditions of late August and early part of September, but not altogether as the Drongos were also late in arriving in October.

The Grey Wagtail (*Motacilla cinerea caspica*), arrived towards the middle of the month; other years I have seen it on September 2nd.

Willow-Warblers were first seen on September 29th, but as I have not noted the date of arrival for other years I cannot say whether this is usual, or late for them. We certainly have two varieties of these engaging little birds, the Greenish Willow-Warbler (*Phylloscopus nitidus viridanus*), and another rather like it, but with no eye-stripe. I have been unable to identify it; it is much less numerous. Through all the winter months the garden is never without several pairs of these birds, and even in May there is an occasional straggler to be seen.

Indian Grey Drongo (*Dicrurus leucophaeus longicaudatus*) arrive in the middle of October. In 1941 October 15th, 1942 October 17th, 1943 October 25th was the first time I heard them, though I think they may have come a day or two before.

As a rule they stay on in good numbers till the middle of February, when the main party seem to leave, but stray and single birds are to be seen and heard on till April.

This year however, there have neither been so many of them, nor have they stayed so long, in fact during the whole of January I have only heard them on three occasions. And now for ten days I have not seen or heard any.

I was interested to note that down in Coonoor there was another variety, not having my binoculars with me I was unable to make out very clearly any special distinctions, except that it was a smaller bird, and had no long streamers to the tail, which was very *swallow-like* in shape. (Probably the Bronzed Drongo—*Chaptia aenea.*—EDS.).

During September and the early days of October the compound is full of Ashy Wren-Warblers, also a few Indian Wren-Warblers. I think both these birds have the trick of making a 'clapping sound', while moving about the undergrowth.

They do not appear to come into the compound after the middle of October at latest. They move up to the thicker bushes and sunnier banks above us for the winter months.

This year I have heard Nightjars calling, much earlier in the year than other years. It has always been into February before I have heard them, but this year it was on the night of the 5th-6th January, about 11.45 p.m. and again 7.15 a.m.

I also saw and heard one on the evening of the 6th. I feel it is almost impossible for me to say which variety it would be about here, but I think it may be the Indian Jungle Nightjar (*Caprimulgus indicus indicus*) the note I hear oftenest is a double one, the second note coming almost like the echo of the first, and is I suppose the *chucker-chucker-chucker* described by Mr. Osmaston, in Baker and Inglis 'Birds of Southern India'.

HEATHCOTE,
LOVEDALE P.O.,
NILGIRIS.
February 3, 1944.

M. E. WOLFE MURRAY.

8.—SNIPE AND DUCK SHOOTING IN SOUTH INDIA 1942-1943, 1943-1944 SEASONS.

I spent two winters in Southern India, one in the Salem District in the Madras Presidency, the other in the Gundlupet area of Mysore. I got off for occasional shoots, and I thought your readers might like to compare the bags of wild fowl.

	1942-43 Salem	1943-44 Gundlupet
Bar-headed Geese	2	2
Cotton Teal	...	54
Pintal	27	19
Gadwall	...	1
Wigeon	...	1
Shoveller	...	62
Spotbill	4	32
Common Teal	4	24
Garganey	19	222
Tufted Duck	3	...
Pochard	...	3
Red-crested Pochard	1	...
Woodcock	2	...
Pintail Snipe	22	17
Fantail Snipe	1	1
Painted Snipe	1	...
Total	86	438

The gadwall bagged near Nanjangud is apparently interesting, as Colonel Phythian-Adams tells me. He has only shot one in the last 18 years. I saw about six wigeon in the same area.

At Salem, shoveller are rare (I only saw four, in March), but up in Mysore they are abundant. Pintail are the most common duck down in Madras, but uncommon in Mysore. Common Teal were uncommon in Madras, but frequent in Mysore, the most I saw being on the Vadaganhalli tank near Bangalore (curiously enough, mostly males). Cotton Teal were rare in the plains—I only saw one—but they are numerous in Mysore.

Here in Burma, it may be interesting to note that snipe and even sandpipers are still about in considerable numbers.

AUBREY BUXTON,
Major.

April 4, 1944.

9.—OBSERVATIONS ON THE EGG-LAYING HABITS OF THE LIZARD (*CALOTES OPHIOMACHUS*)

A slender green lizard, *Calotes ophiomachus,* was noticed for a few days sitting sluggishly on one of my garden plants. One day, looking out through the window, I saw it on the ground, just below, digging a pit with its feeble forelegs—using one leg a number of times, and then the other. The process was slow, and the amount of earth removed very small. Often it paused for a considerable time. Any disturbance or noise would cause it to stop work. The pit, about two inches in depth and one and a half inches in diameter, was at last dug, and in it about half a dozen white eggs were laid. Then the process of covering up the pit began.

I expected a simple filling up. What happened surprised me.

With one of its fore limbs, the lizard pushed a little earth into the pit and then began to press down the soil with its snout. A most laborious process ! After a few dabs with the snout the animal rested a while, and then resumed the task. All round and in the interspaces between the eggs it pressed in mud. Then more soil were scratched into the pit and the process of beating it down repeated. In this way, the pit was completely filled. But the process did not end there. It was hard laterite soil with a lot of gravel and pebbles on the surface, where some weeds (*Centella asiatica*) had rooted. In beginning the excavation, the lizard had removed the surface gravel and pebbles and uprooted the weeds. Now, when the covering up process was completed, the weeds were replaced, pressed in by the snout and then the gravel and the pebbles re-spread. When the mother left the spot it was indistinguishable from the area around. I found it extremely difficult to locate and had to dig up in several places. Her 'forethought' for her brood consisted thus of :—1. filling in the pit so perfectly that it was as hard as the soil all around. A few hours after there was a shower of rain but the recently filled up pit did not suffer. 2. The lizard re-made the surface just as it was before, arranging the gravel, pebbles and weeds in position, betraying no signs of any recent exacavation and subsequent filling up.

Though it is well known that lizards and most reptiles bury their eggs in the soil for hatching, I have not come across any account of such care taken by the mother in filling up the pit and camouflaging its surface, though certain turtles are known to behave in a similar manner.

A. P. MATHEW.
Department of Zoology,
The University College,
Trivandrum.

TRIVANDRUM,
January 1, 1944.

10.—CROCODILES BELLOWING.

Until recently I had always imagined the mugger to be a silent brute. He never speaks to shot like some warm-blooded animals, nor of course, like the lion, does he go roaring after his prey. In one of Blackwood's tales (March 1938), Ostler however mentions that in Africa he had heard a crocodile utter a hoarse roar when shot and that adults are said to bellow at nights; but *C. vulgaris* of Africa is on the whole a larger beast than his cousin *C. palustris* of the Indian tank and river and may have acquired this vocal distinction as a result of different conditions of living and environment.

I was walking up the left bank of the River Indravati, one afternoon in February on the off chance of getting a shot at a mugger. My orderly was following some 25 yards behind carrying my ·30 Springfield Mauser.

Having sighted a very young one some 3 feet in length sitting on a log in the water, I approached quietly to see how near I could get before he slid in. The log was opposite a shelving part of the otherwise steep bank where I had some weeks before seen a mugger sunning itself.

While the shelving part was still obscured from view by the grassy top of the bank, I heard what I imagined to be a water buffalo or bullock lowing, as they very often do, while coming out of water after drinking. The lowing bellows were repeated two or three times in quick succession, and my first reaction was to discard further caution in approach and to continue on up the river.

As I started however I caught sight through the grass of a massive crocodile, his mouth wide open waddling up the bank out of the water. Close to him was another 7-footer already lying in the sun.

I slipped back to where the orderly was standing, took the rifle and returned *á la cobra* to the top of the bank. The two muggers were lying side by side, neither was moving and baby was watching from the log. I did not wait to see whether the big one's bellow was an invitation to waltz or a request to the smaller one to move on, but put a bullet into his neck immediately.

The bullet appeared to have broken the neck thus preventing all motive power from the brain reaching the body. The latter was in fact dead though the head was certainly alive. He taped 12 feet 4 inches, girth 5 feet 3 inches, and took twelve men and boys to lift. His belly contained three pieces of a silver ornament and some broken iron fish hooks. This particular saurian was reported to have pulled in a full grown buffalo in December and was not itself seen again for some days afterwards.

It would be interesting to know the significance of the bellowing at 3.30 p. m. in the afternoon and whether a similar instance has been previously recorded.

R. K. M. BATTYE,
Major, I. P. S.

BASTAR STATE,
February 23, 1944.

11.—THE ZONAL DISTRIBUTION OF THE MOLE CRAB (*EMERITA ASIATICA*) ON THE MADRAS COAST.

The Anomuran decapod, *Emerita asiatica*, is one of the most abundantly represented species in the inter-tidal zone of the Madras Coast.[1] The species is of common occurrence at various places along the Indian Coast and at Madras they are found in large numbers, throughout the year. Larger specimens of this mole crab are daily caught in hundreds by the fisherfolk who use them for food.

---

[1] *Emerita asiatica* occurs in large numbers along the Malabar Coast, particularly at Cochin and Cranganore; but here besides the typical specimens a variety of rather stunted or dwarfish individuals also occurs. This variety is easily distinguished from the *forma typica* by the peculiar pigmentation on the dorsal aspect of the cephalothorax. While it is of a uniform colour in the typical specimens, the cephalothorax in variety bears a distinct pattern—on a brown background, a longitudinal median white streak which is less conspicuous

It is well known that on the sea bottom animals group themselves into what are called 'communities'; certain species of animals living together in a particular locality, on a particular substratum, to form a community. On the sandy beach this sort of distribution results in what is termed 'zonation of species', the zone occupied by a particular species or a group of species being in direct relation to its distance from the high tide level, and the nature of the substratum. On the Madras Coast, *Emerita asiatica* not only illustrates this phenomenon clearly but also shows the preference for particular kinds of substrata at various stages of its growth.

Emerita asiatica breeds almost throughout the year, with a period of maximum intensity from January to April. During November and December, i.e. the north-east monsoon period, the majority of specimens are soft-skinned, having undergone moult, and have the ovaries fully developed, while some of them are berried, carrying eggs attached to the pleopods. By the end of December most of the specimens are berried and from January onwards the larvae begin to appear in large numbers in the plankton. By the end of February these larvae begin to metamorphose and the early post-larval or pre-adolescent stages settle down on the sandy beach. Some idea of the number of young ones produced during each season can be obtained from the fact that a sample of sand, a quarter of a square metre in area, and about three inches in depth, taken from the particular zone, sometime in March, often yields young *Emerita*—of size varying from 3 to 5 mm.—sufficient to fill a one-pound kilner jar.

The distribution of *Emerita* in the inter-tidal zone is peculiar. The smallest specimens, which teem literally in thousands, are found very near high water level, restricted to a narrow zone, about two yards in width, along the entire Coast. The substratum here is formed of fine sand which is somewhat loosened by the numerous specimens that burrow in it. At low water level the substratum is coarse grained and the largest specimens measuring about 2 to 2½ inches, are found in this region. Between these two zones specimens of intermediate sizes are found; larger ones nearer low water level and smaller ones nearer high water level. There is thus a distinct zonation in this species, both with reference to size as well as to substratum; the smallest specimens being commonest in fine sand near high water mark, and the largest in coarse sand near low water mark. The specimens, especially smaller ones, are often dislodged from the sand and carried away by the incessant waves, to some extent resulting in the mixing up of individuals of different sizes. It is, however, remarkable that while some of the smaller specimens

---

anteriorly where it is connected by curved white lines to two white spots on either side, and then ending in a pale spot. It is interesting to observe that the size at maturity in these dwarfish individuals is relatively small, berried females measuring only about 10 mm. being quite common. In the typical form, however, sexual maturity in the female is attained only when the specimen grows to about an inch or more in length. It is peculiar that the two forms occur side by side in the same substratum.

are carried towards the low water level, larger ones are rarely found near high water mark.

The distribution of a species on a sandy beach will be influenced by various factors such as the nature of the substratum, time of exposure, availability of food, etc. In the case of *Emerita* the young specimens prefer a substratum of fine sand, and the larger ones, a coarse substratum. This preference is probably explained by the fact that the larger particles of the coarse substratum, constantly rubbing against each other forcibly by wave action, often prove fatal to the small individuals, while the larger specimens, capable of withstanding the churning effect of the coarse particles, can easily burrow into the loose substratum.

Emerita derives its food from the minute organisms that are drawn into the current of water set in by the antennules—a phenomenon that can be easily observed if a couple of active specimens are placed in a glass dish containing some sand and sea water. Along the sandy beach they burrow themselves facing the sea, and with each incoming wave prop up their heads, the antennules are held in position and the current is set up. When the wave recedes they burrow into the sand again, so that the chances for procuring food directly depend upon the length of time they are submerged under water. The substratum at low water level being submerged during most of the time the larger specimens have greater chance of procuring food, whereas near high water mark the period of exposure, is long, the area being submerged only for a short time, during high tides. During the major portion of the day this zone is exposed to the direct heat of the sun resulting in considerable dessication due to evaporation. One can imagine the severe struggle for existence that is going on in this over-populated area, when during the very short time they are covered by water, they busily try to secure their day's rations!

The above observations were made while I was carrying on an investigation of the fauna of the sandy beach, Madras, under Prof. R. Gopala Aiyar, Director, University Zoology Laboratory, Madras, to whom I am deeply indebted for the valuable help he extended to me.

DEPARTMENT OF NATURAL SCIENCE,
MAHARAJA'S COLLEGE,
ERNAKULAM.
24th April, 1944.

K. H. ALIKUNHI, M.SC.

[A note with illustrations of both sexes of *E. asiatica* appeared in Volume xxxvii, p. 699 of the *Journal*.—EDS.]

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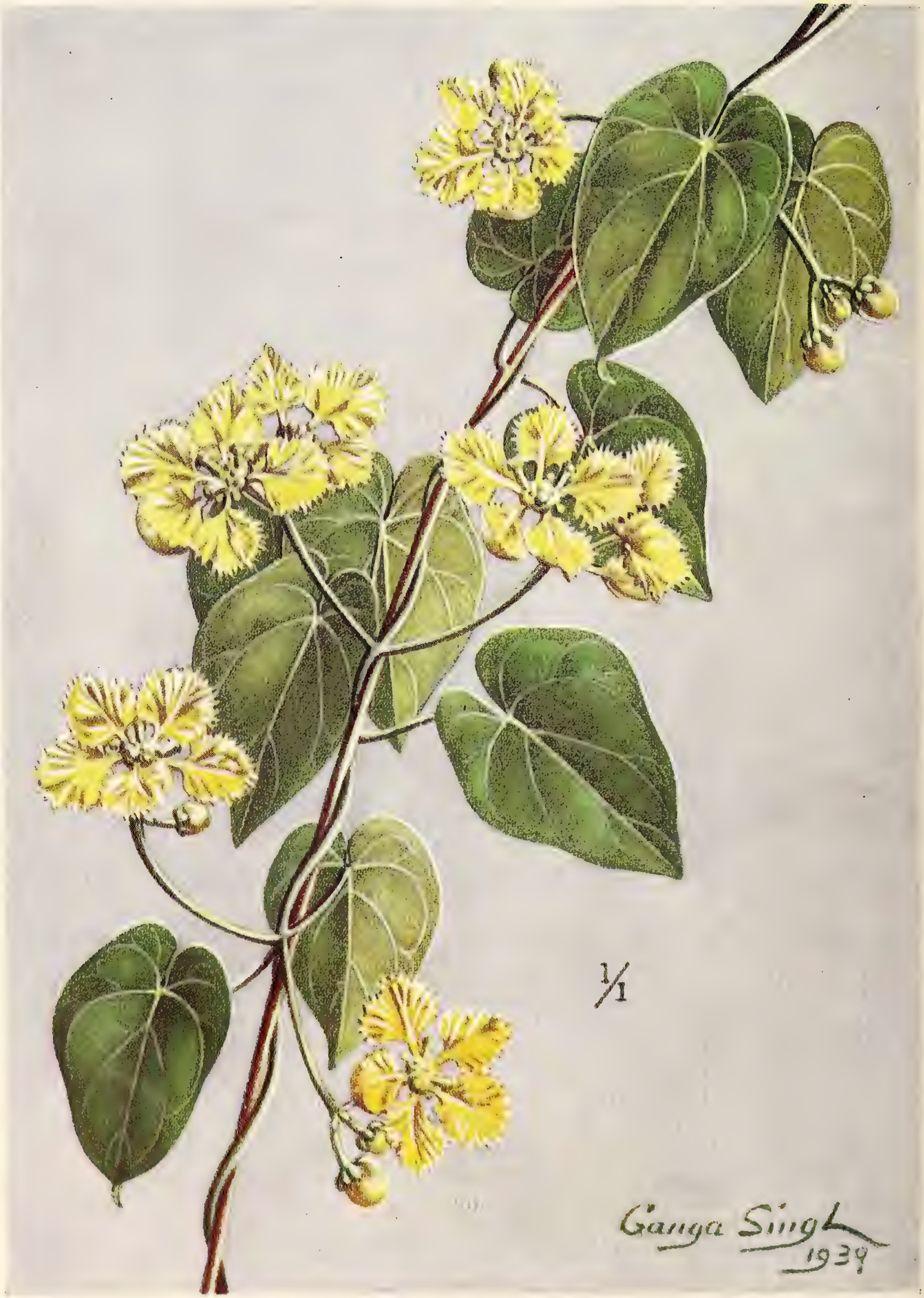
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SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS

BY

N. L. Bor, C.I.E., M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

M. B. Raizada, M.SC.,

Assistant Forest Botanist,

Forest Research Institute, Dehra Dun.

Part XIX

(*Continued from Vol.* 45, *No.* 1 (1944), p. 4).

(*With* 2 *coloured,* 4 *black and white plates and* 5 *text-figures*).

Malpighiaceae

A family of flowering plants which commemorates the name of Marcello Malpighi, 1628-93, a distinguished Italian botanist, who wrote on the anatomy of plants. The family comprises trees, shrubs and climbers, some of which are grown in Indian gardens. The leaves are opposite and glands are often present either on the petiole, on the margins or on the under surface of the leaves. Stipules are either present or absent, sometimes large and connate. The flowers are usually hermaphrodite. Sepals five in number, often with two large glands outside. The petals are also five, clawed. Stamens usually 10. Ovary sessile on an obscure disk, usually of three carpels, free or united with 1 ovule in each cell Styles usually 3, mostly free. Fruit sometimes winged.

The hairs on the shoots of many species are very peculiar and if found on a leafless twig are quite sufficient to place the plant in this family. These hairs are one-celled and branched and are found in three forms (*a*) the magnet-needle type, (*b*) the forked type and (*c*) the morning-star type. The first type has a short pedicel upon which is attached at right angles the two arms of the hair; these may be straight or curved. The foot may be very short in which case the hairs appear to be attached to the under surface by the centre. This type of hair gives a silvery or metallic sheen to the shoot. The second type of hair, in which the foot is long or short, supporting two arms, gives a felty or woolly appearance to the shoot. The third kind of hair, the morning star type, consists of a foot upon which is found a globular many-branched head. Hairs of this kind give a mealy appearance to the shoot, which recalls the indumentum of many species of *Chenopodiaceae*.

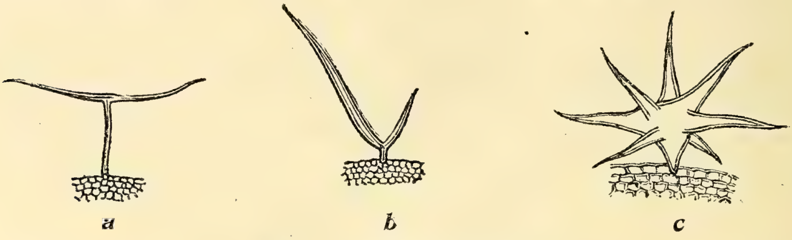


Fig. 1.—*Forms of Hairs.*
(*a*) Magnet-needle type, (*b*) forked type, (*c*) morning-star type.

The growth of the stems of certain climbing species resembles that of some species of the *Bignoniaceae* already mentioned in Part III of this serial. Localised growth often leads to deformed stems in which deep clefts are succeeded by protruding woody portions.

Characteristic of the *Malpighiaceae* are the glands which are found so often on stem, under surface of the leaves and upon the outer surface of the sepals. What purpose these glands serve is not known.

The following climbing genera of *Malpighiaceae* are cultivated in India: *Stigmaphyllon, Hiptage* and *Banisteria*. *Galphimia* is a common shrub.

The climbing species may be distinguished from one another as follows:—

Style 1. ... *Hiptage.*
Styles 3.
  All the stamens fertile; style tops obtuse. ... *Banisteria.*
  Four of the stamens sterile; style tops leaf like. ... *Stigmaphyllon.*

Hiptage Gaertn.

(The generic name is derived from the Greek verb *hiptamai*, meaning 'to fly', and refers to the winged fruits of the genus).

A genus of erect or climbing shrubs. Leaves opposite, entire, exstipulate, sometimes glandular within the margins. Flowers in axillary or terminal racemes, rarely in congested leafy panicles; peduncles bracteate, articulated with the 2-bracteate pedicels. Calyx 5-lobed with one large, oblong or linear gland outside and partly on the pedicel. Petals five; four equal in size, white, the fifth yellow. Stamens 10, declinate, one much larger than the others; filaments connate at the base. Ovary 3-lobed; styles 1-2. Fruit a collection of winged seeds.

Hiptage madablota Gaertn. (*H. benghalensis* (L.) Kurz).

(The Sanskrit name for this plant is *madhabilata*, hence the specific epithet.)

Description.—A large evergreen scandent shrub reaching a height of 12-15 ft., with a dark coloured stem, rough from numerous lenticels. Leaves opposite, usually without stipules, 4-6 in. long, up to 3 in. broad, coriaceous, dark green and shining above; petiole 2-5 in. long, glabrous or finely hairy below; nervation prominent below. Flowers showy, fragrant, in large terminal and smaller axillary panicles; peduncles and pedicles continuous, 5 in. long with a pair of bracteoles at the centre, covered with dense, appressed, short, silky hairs. Calyx 5-lobed, covered with a dense, silky pubescence; lobes obtuse. A large linear or oblong gland will be found outside partly on the calyx and partly on the pedicel. Petals 5; clawed, with an obovate or sub-orbicular limb, silky outside, glabrous within, fimbritae on the margin; four equal in size, white in colour, the fifth smaller and pale yellow, all reflected in the open flower. Stamens 10, one much larger than the others; filaments connate at the base; anthers ovate. Ovary pubescent, 3-locular; style 1-3 in. long, filiform, circinate in the bud. Fruit of 1-3, 3-winged samaras.

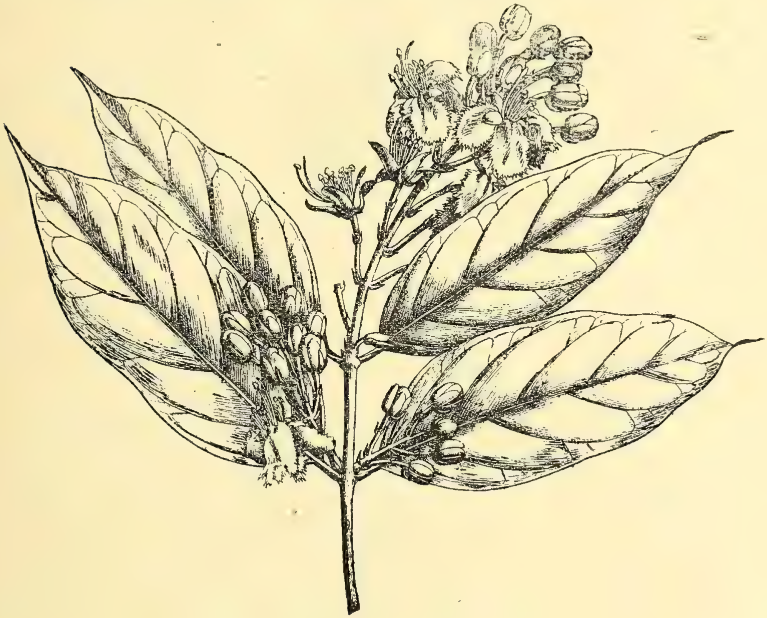


Fig. 2.—*Hiptage madablota* Gaertn.

Flowers.—February-April. *Fruits.*—May-June.

Distribution.—Native of India and Malaya, cultivated in gardens in the plains throughout the country.

Gardening.—A large, evergreen, rampant, climbing shrub. It is attractive when in full bloom with its profuse trusses of white and yellow fragrant flowers borne on short spikes and resembling somewhat those of the Horse-chestnut. It is rather a heavy climber and needs a great deal of space. It would look well on a strong trellis or as a screening material, but prefers a protected aspect. Propagated by seed.

Medicinal uses.—The leaves are considered medicinal and are useful in chronic rheumatism and skin diseases. It is also said to possess insecticidal properties.

Banisteria Linn.

(The genus *Banisteria* was erected by Linnaeus in honour of John Baptist-Banister, an English traveller and botanist).

A genus of erect or climbing shrubs with opposite entire, petiolate, exstipulate leaves. The inflorescence is usually a terminal panicle with pedicellate flowers; pedicels bracteate and bracteolate. Calyx of five sepals, each of which (or only four) bears on its back two roll-shaped yellow glands. Petals five, usually pink, sometimes yellow, clawed. Stamens 10, filaments often of different lengths. Ovary of three connate carpels each with a separate style, truncate at the apex; ovule solitary in each loculus. Fruit winged.

Banisteria laevifolia Juss.

(*Laevifolia* is Latin for 'smooth-leaved').

Description.—This species is an extensive climbing shrub with rather slender dark brown stems and branches. Branches and branchlets terete, covered with a whitish matted felty tomentum when young, but finally glabrous. The terminal branchlets droop. The leaves are opposite, petiolate (petiole ·25 in. long, curved, covered with similar tomentum to that on the shoot), cordate at the base, rather variable in shape, being elliptic, elliptic-obovate, ovate-lanceolate or lanceolate, thinly coriaceous in texture, acute or acuminate at the tip, dark olivegreen above and smooth below, covered when young with a silvery-white silky tomentum which becomes shaggy and dark coloured with age, 4 in. long by 2-5 in. broad; margins entire; venation impressed above, prominent below. On the nerves below one or two sessile globular yellow glands are to be found.

Inflorescence of trichotomous umbellate panicles i.e. the flowering shoot divides into three peduncles, each of which is surmounted by a false umble. Common peduncle of the false umble under .5 in. long. Flowers ·5 in. in diameter, yellow, pedicellate, not all arising at the same point but arranged racemosely along a very short axis; pedicels supported by bracts and bracteoles ·25 in. long, covered with a yellowish silky tomentum. Sepals 5, about ·08 in. long, ovate or obovate in shape, acute at the apex covered with a yellowish silky tomentum, each sepal bearing on its back two yellowish fat sausage-shaped glands, or glands absent from one sepal. Pttals 5, alternate with the sepals, orbicular or elliptic

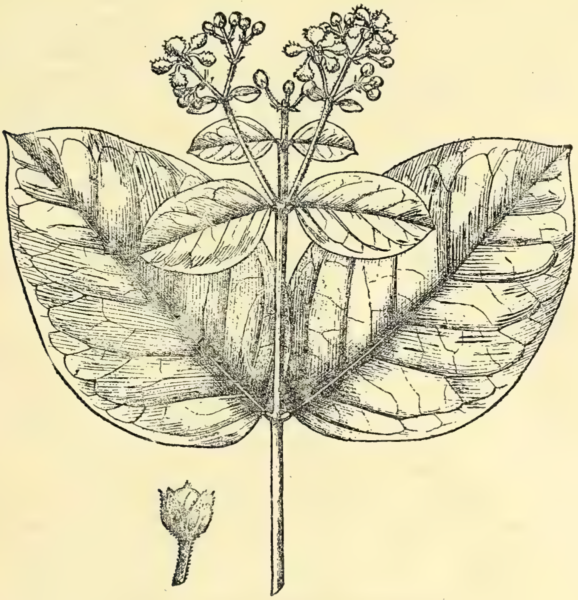


Fig. 3.—*Banisteria laevifolia* Juss.

in shape, depressed in the centre, almost bowl-shaped, arising from a short stout claw, ·3 in. long, margin toothed, fimbriate or lacerate. Stamens 10; filaments short and squat, those of the stamens opposite the sepals shorter than the others; anthers 2-celled finally at right angles to the filament, opening by slits. Ovary ovoid, covered with a silky tomentum; styles three, truncate at the stigmatic tip. In the fruit 1-2 carpels develop a wing on the back which eventually reaches a length of ·5 in., reddish in colour and covered with a silky tomentum.

Flowers.—Hot and rainy season. *Fruits.*—Cold season.

Distribution.—Indigenous to Brazil, now commonly cultivated in all tropical and sub-tropical parts of the world.

Gardening.—A rather extensive climber with lanceolate, rigid, dark olive-green leaves. The large sprays of yellow flowers make it a very handsome object when in bloom. Propagated by layers or seeds which it produces abundantly.

Stigmaphyllon Juss.

(The generic name is derived from two Greek words meaning *stigma* and *leaf* and refers to the leaf-like appendages of the stigmas).

A genus of woody twiners with opposite leaves. Two glands are visible, usually near the top of the petiole. The flowers are arranged in short, dense, sessile corymbiform racemes. Pedicels usually with 2 bracteoles above the middle. Sepals 5, the four lateral with two glands each. Petals 5; clawed, glabrous, yellow, unequal, the four lateral concave; margin toothed or fringed. Stamens 10, 4 opposite the lateral petals more or less sterile; filaments various. Ovary 3-lobed, 8-locular; styles 3, short with the top dilated into an appendage. Fruit consisting of 3 samaras.

A genus of about 60 species, the great majority of which are twiners, indigenous in the tropics of America. Niedenzu, who monographed the family *Malpighiaceae*, spells the generic name *Stigmatophyllum* A. Juss. Actually it was Spach who spelled the name thus in 1834 in one of his publications. Jussieu published the name, *Stigmaphyllon*, in 1832, and it has priority.

KEY TO THE SPECIES.

Leaves cordate.	*S. ciliatum.*
Leaves elliptic, oblong or linear.	*S. periplocifolium.*

Stigmaphyllon ciliatum (Lamk.) A. Juss.

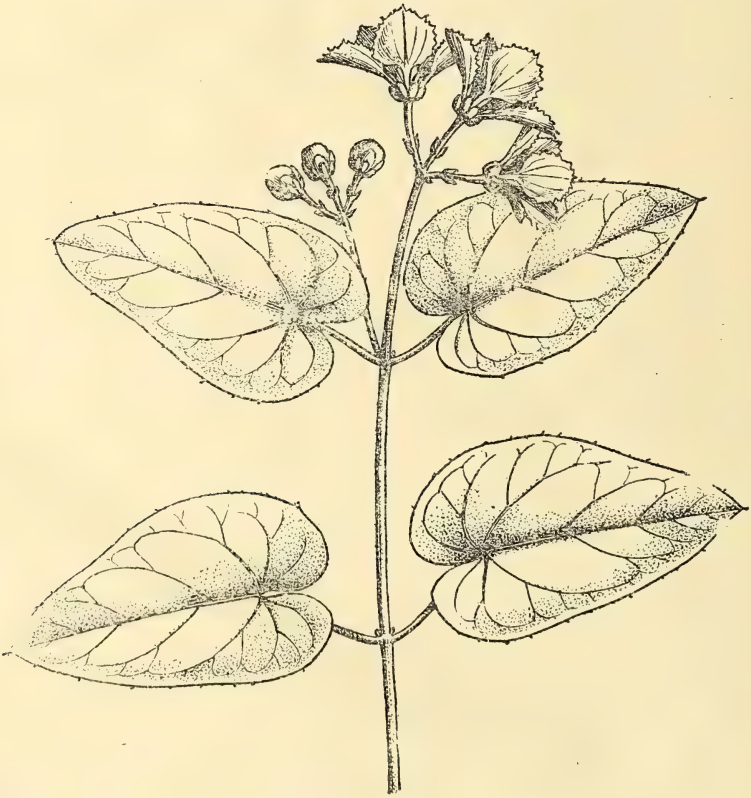


Fig. 4.—*Stigmaphyllon ciliatum* (Lamk.) A Juss.

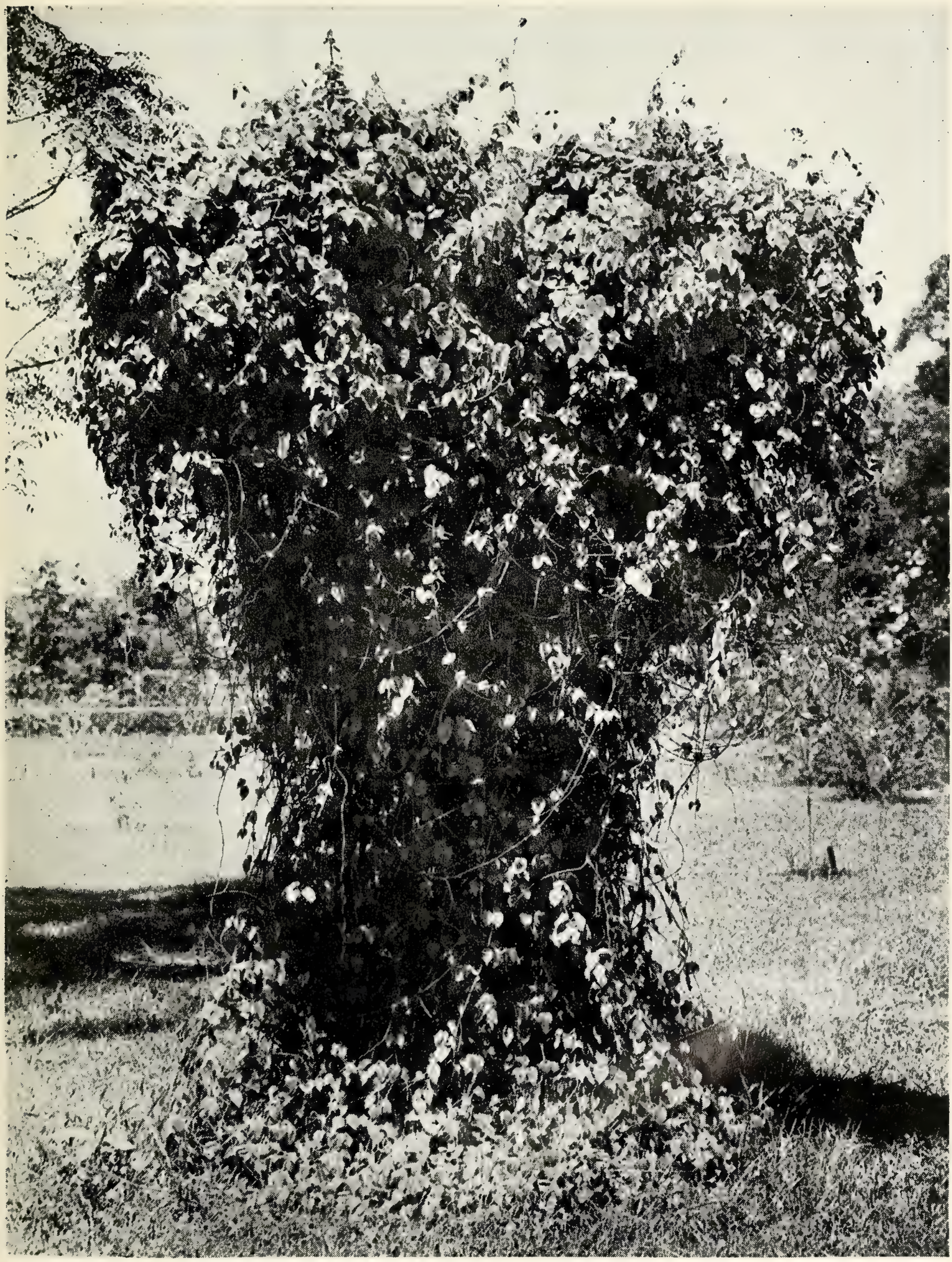


Photo by *Stigmaphyllon ciliatum* (Lamk.) A. Juss. M. N. BAKSHI.
New Forest, Dehra Dun.

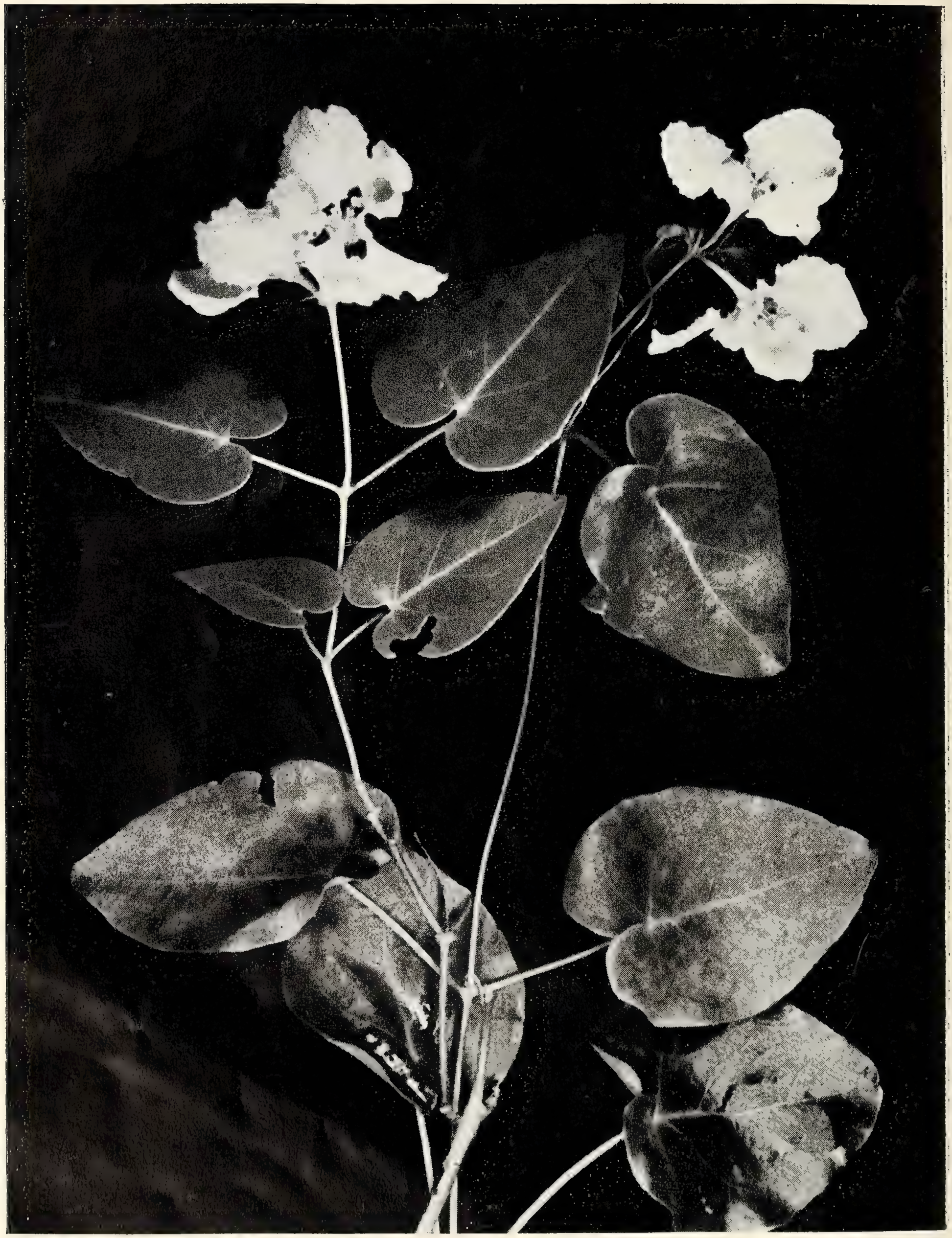


Photo by *Stigmaphyllon ciliatum* (Lamk.) A. Juss. M. N. Bakshi.

New Forest, Dehra Dun.

(*Ciliatum* means hairy on the margins and refers to the fringes of glands on the margins of the leaf; derived from the Latin *cilium*, meaning 'eyelid'.)

Description.—A slender twiner with cylindrical stem covered in youth with dense, white, medifixed hairs. Leaves opposite, up to 3 in. long by 3 in. wide, petioled, ovate, obtuse or round in shape, deeply cordate and lobed at the base, palmately nerved, the side nerves being produced beyond the margins and ending in short red glandular processes, covered when young with white, appressed, medifixed hairs, glabrescent in age; petioles up to 1.25 in. long furnished with two green elliptic glands at the apex; stipules minute.

Flowers yellow, up to 1.3 in. in diameter, arranged in umbel-like corymbs which are peduncled and axillary. Peduncles up to 1 in. long, slightly swollen at the apex and sparsely covered with blackish hairs. Umbel of 3-4 pedicellate flowers with two bracts at the base. Bracts lanceolate, glandular-laciniate, with 2 large greenish glands at the base. Pedicels clavate with 2 bracteoles at or just above the base. Calyx 5-partite with 8 glands outside; lobes obtuse. Petals 5, four equal in size, one much smaller, all definitely clawed; limbs orbicular or rounded-oblong, concave, irregularly fringed, yellow. Stamens 10; filaments of three, thick and long, the remainder short; anthers oblong blunt, opening by pores and containing a sticky mass of brown pollen grains. Ovary sunk in or seated upon an obscure disk, 3-celled; styles 3, expanded at the top into leaf-like appendages, which arch over and cover the anthers of the three large stamens; stigmatic areas on the lower surface.

Flowers.—Rainy season. *Fruits.*—Cold season.

Distribution.—A native of tropical America now widely cultivated throughout the tropical and subtropical parts of the globe.

Gardening.—A medium-sized 'vine', with dark green, attractive foliage almost ivy-like in form. The large clusters of extremely attractive golden-yellow flowers which appear during the rains are very effective. It is suitable for a small trellis or archway and is not particular in its soil requirements. Propagation by layers and seed.

Stigmaphyllon periplocifolium (Desf.) A. Juss.

(The specific name refers to the similarity of the leaves of this species to those of *Periploca graeca* L., a genus of the *Asclepiadaceae*).

Description.—A twining shrub. Stems cylindrical, lenticellate, dark red or brown, glabrescent or slightly hairy. Young parts covered with silky medifixed hairs, becoming glabrous with age. Leaves opposite or subopposite, elliptic-oblong or linear in shape, shallow, cordate or entire at the base, emarginate or apiculate at the apex, 1-5 in. long, glabrous or glabrescent on both surfaces, coriaceous; nerves prominent below; petiole ·25-1 in. long, with a pair of stalked glands at the apex.

Flowers yellow, up to ·75 in. in diameter, arranged either in more or less elongate racemes or in more or less subumbellate corymbs; peduncles up to ·75 in. long; pedicles 6 in. long; peduncles and pedicels covered with appressed silky hairs. Calyx 5-lobed; lobes reflexed at the margins, ovate acute in shape, supported below by 5 oblong glands. Petals 5 in number, yellow, clawed, four subequal in size, the fifth smaller; limbs suborbicular, entire or crenulate on the margin. Stamens 10, of which four opposite the lateral stamens are more or less sterile, the rtmaining 6, i.e. those opposite the petals and the remaining sepal are fertile. Ovary of three combined carpels, very tomentose with three styles; apex of the styles expanded into a small leaf-like triangular appendage.

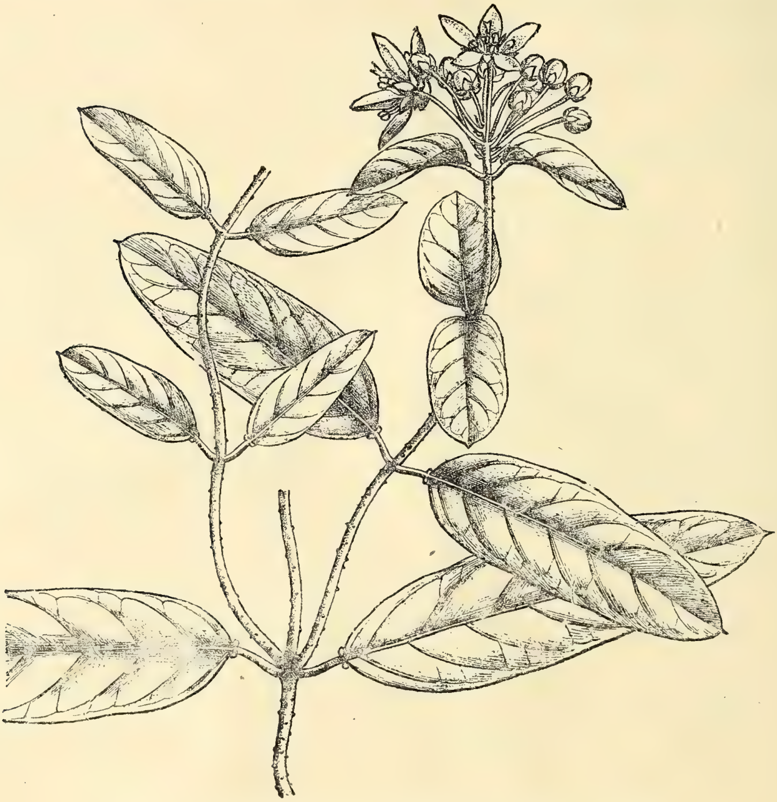


Fig. ·5.—*Stigmaphyllon periplocifolium* (Desf.) A. Juss.

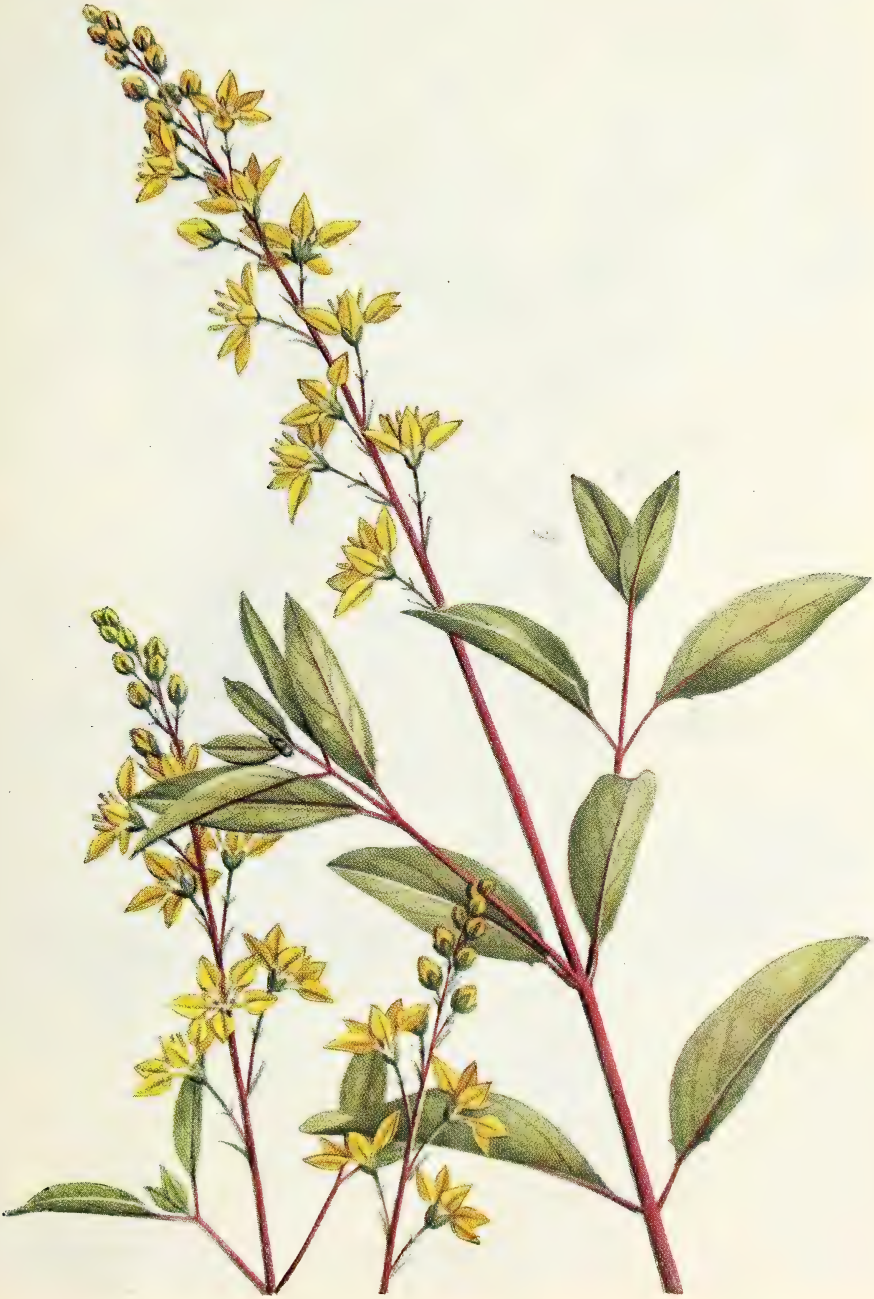
Flowers.—Rainy season. Does not fruit in Dehra.

Distribution.—Native of tropical America, now common in cultivation throughout the country.

Gardening.—A handsome scandent shrub which produces fine yellow flowers during the rains. Propagated by layers.

Galphimia Cav.

(The generic name is an anagram of *Malpighia*, another and closely allied genus of this family.)



GALPHIMIA GRACILIS Bartl.
(Nat. Size.)

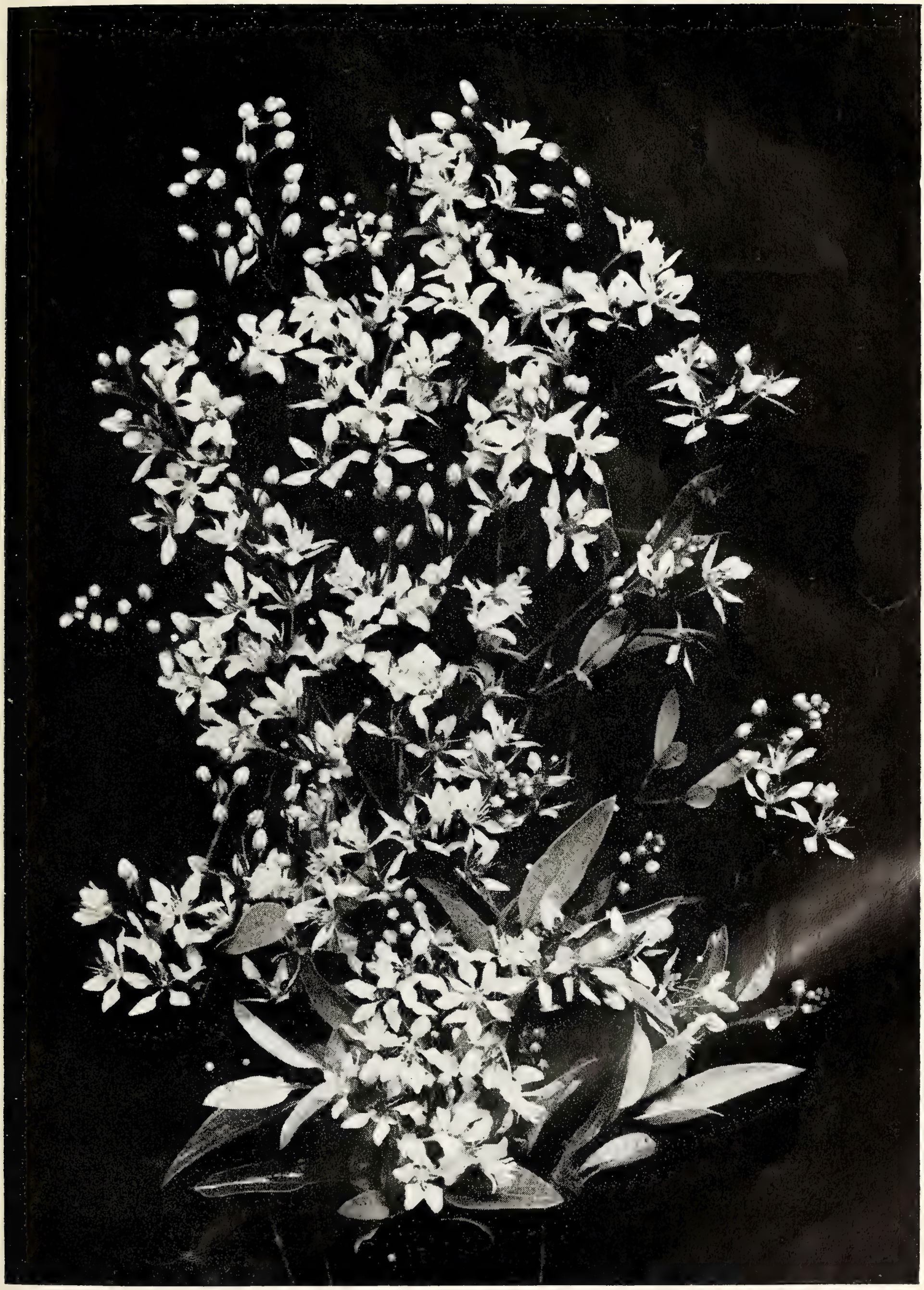


Photo by M. N. Bakshi.

Galphimia gracilis Bartl.
New Forest, Dehra Dun.

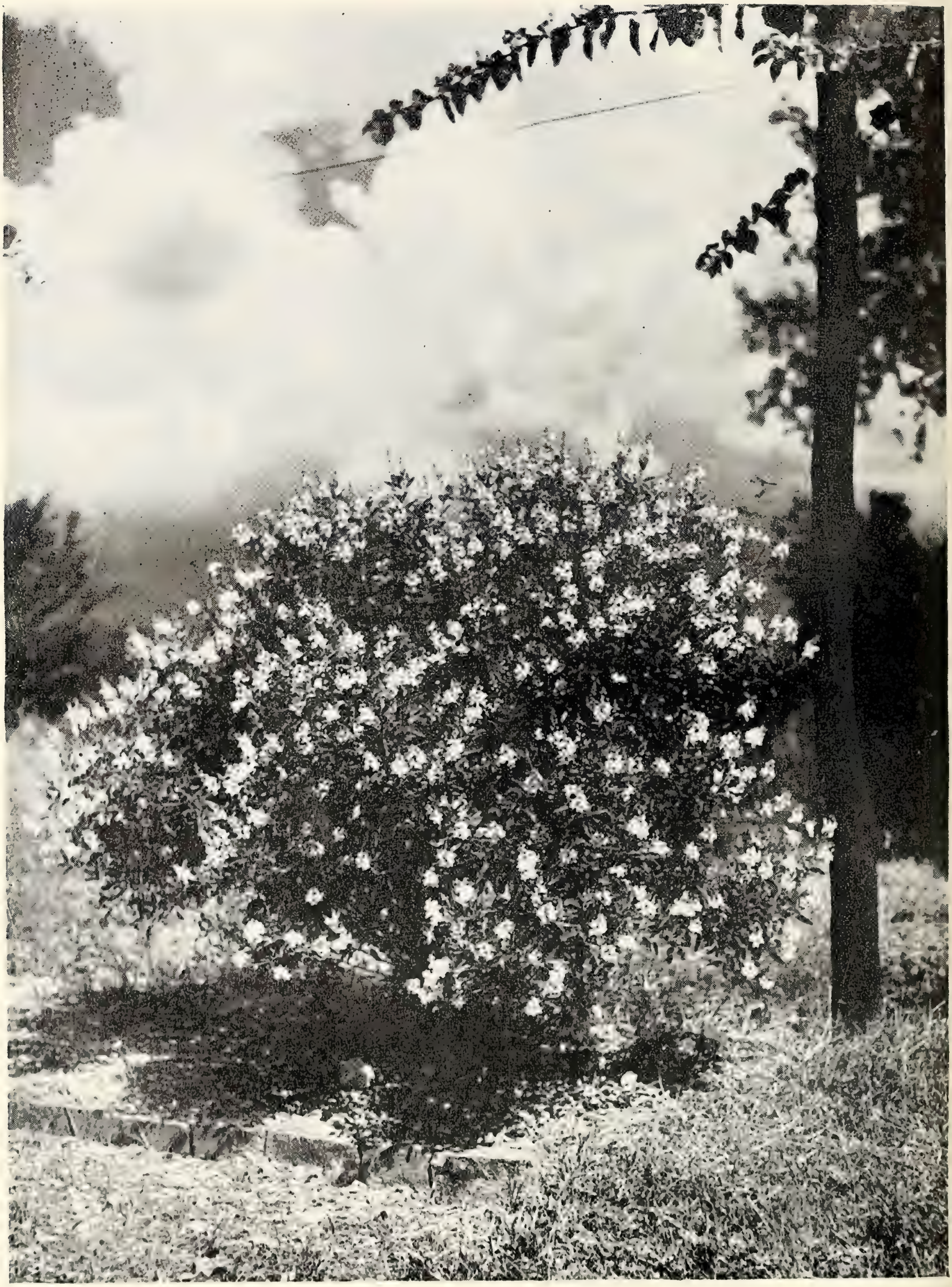


Photo by M. B. Raizada.

Galphimia gracilis Bartl.
New Forest, Dehra Dun.

The genus consists of shrubs or undershrubs. Leaves opposite, petioled, with linear stipules often glandular on the margins or on the petiole. Flowers terminal, yellow or red; calyx without glands; petals clawed, stamens 10. Fruit a capsule. A small genus of about 10 species, all tropical American.

Galphimia gracilis Bartl.

(*Gracilis* is Latin for 'slender' and refers to the long slender branches of the plant).

Description.—A handsome shrub reaching 6 ft. in height. Old branches a shining brown slightly fissured, sparsely covered with dark-red short hairs, young parts densely covered with dark-red hairs. Leaves opposite, up to 2 in. long by 1 in. wide, petioled, stipulate, ovate or ovate-oblong in shape, unequally cuneate at the base, obtuse at the apex or sometimes apiculate, covered on both surfaces with rufo-sericeous pubescence when young, afterwards glabrescent though it is usual to find hairs on the mid-rib beneath, with two glands, one on either side, on the margins just above the base; petiole channelled above, up to 4 in. long, puberulous; stipules linear, hairy, persistent.

Flowers arranged in more or less dense, erect terminal racemes, 3-4 in. long, 10-30-flowered. Individual flowers seated on stalks from the main axis; each stalk supported by a bract and bearing two bracteoles at the centre. Calyx 5-partite without glands; lobes obovate or oblong-ovate in shape, green, .25 in. long. Petals 5, yellow, clawed, ·25-5 in. long; limb subcordate in shape or ovate minutely fimbriate on the margin; claw ·1 in. long in four petals, that of the fifth ·2 in. long. Stamens 10; filaments very unequal ·1-·2 in. long reddish at the base; anthers yellow, large, oblong-obtuse. Ovary ellipsoid, 3-locular, smooth and glabrous. Style 3-4. Fruit a spherical capsule, ·2 in. in diameter.

Flowers.—Almost all the year round but profusely during July-November. *Fruits* cold season.

Distribution.—Native of tropical America now extensively cultivated throughout the plains of India.

Gardening.—A hardy, evergreen, handsome shrub about 4-6 ft. high. It is covered most of the year with small golden yellow flowers which against the dark green foliage of the plant are very effective. The plant will stand wind and poor soil but prefers a protected site and full sun. It has been recommended as a hedge but shows itself best when planted in a clump. Propagation is by seed.

MATERIALS FOR THE ORNITHOLOGY OF AFGHANISTAN

BY

HUGH WHISTLER (Deceased).

PART III

(Continued from Vol. 45, No. 1 (1944), p. 72).

Acrocephalus stentoreus brunnescens (Jerdon).

Specimens collected.—♂ 20-4-1879, ♂ 1-6-1880 Kandahar (St. John); ♀ 20-5-1879 Byan Khel (Wardlaw-Ramsay); 2 sex? 15 May Kila Wali, Murghab (Yate); ♀ 28 May 1933 Kabul, ♀ 6 August 1933 Baqrami, 5,700 ft., ♂ 6 May 1934 Chaharasia 5,700 ft., ♀ 21 June 1934 Logar 5,700 ft. (Maconachie); ♂ 23 April Bamian 8,500 ft., 4 ♂ 1 ♀ 5-9 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

In the first week of May Meinertzhagen found the Indian Great Reed-Warbler commencing to breed at Danaghori where the large expanse of reeds is well suited to its requirements. It was also breeding, he says at Kunduz on 20 May and at Jalalabad on 31 May. Maconachie notes that it was plentiful in the reeds at Baqrami on 6 August. It is no doubt a summer visitor to Northern Afghanistan.

Wardlaw-Ramsay obtained a single bird at Byan Khel 7,000 ft. on 20 May which was evidently on passage as were probably St. John's two specimens collected at Kandahar on 20 April and 1st June.

Acrocephalus agricola Jerdon.

Specimens collected.—♂ 21 June 1934 Logar (Maconachie) 2 ♂ 15 April Ghorband 6,500 ft., 1 ♂ 2 ♀ 2 May Doshi 2,750 ft., ♂ 7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The status of the Paddy-Field Warbler is not quite clear. Meinertzhagen says that the Doshi and Danaghori birds should have been breeding by the state of their organs. They were in long grass and coarse reeds but not over water. Maconachie's specimen also had the organs enlarged. Sir Alexander Burnes is said to have obtained it at Kabul.

Acrocephalus concinens haringtoni Witherby.

Specimens collected.—2 ♂ 5-6 May 1937 Danaghori.

Meinertzhagen says that these specimens of Harington's Reed-Warbler were found in the reeds at Danaghori in company with the Great Reed-Warbler. They were singing lustily and apparently in their breeding quarters. The examination of fresh material has satisfied me that *A.c. hokrae* is not separable from *A.c. haringtoni*.

Acrocephalus dumetorum Blyth.

Specimens collected.—♂ 13 May 1879 Byan Khel (Wardlaw-Ramsay); ♂ 21 May Kunduz 1,400 ft., 2 ♀ 24 May 1937 Ghorband 8,300 ft. (Meinertzhagen).

Meinertzhagen is of opinion that Blyth's Reed Warbler was breeding in both the above localities. At Kunduz it was common on the banks of the Khanabad River in bushes but not in reeds.

Wardlaw-Ramsay's specimen collected at Byan Khel 7,000 ft. on 13 May was one of a couple seen, doubtless on passage.

Agrobates galactotes familiaris (Ménétries).

Specimens collected.—♂ 24 April 1881 (Swinhoe); 3 ♂ 1 ♀ 12-28 April 1885 Tirphul, ♂ 1 May 1885 Kambas (Aitcheson); sex? 22 April Kila Wali, sex? 18 May Darbund-i-Kil Rekhta (Yate); ♀ 22 April 1905 Kuhak (Cumming); ♀ 4 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The Grey-backed Warbler is a very common summer visitor to the tamarisk groves by the sides of streams on the Hari-Rud, where Aitcheson considered its song almost equalled that of the Nightingale. Yate also met it on the Murghab. Cumming found it equally common on the banks of the Rud-i-Seistan at Kuhak where he obtained c/5 eggs on 11 May. St. John considered it tolerably common in the Kandahar area. Yet curiously enough Meinertzhagen only met with two individuals—the above female, which was actually singing on a mud wall surrounding crops when shot, and a second specimen shot between Baghlan and Khanabad about 1,700 ft. on 19 April.

Lusciniola melanopogon mimica Madarász.

Specimens collected.—♂ ♀ 20 April 1879 Kandahar (St. John); ♂ 7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

Meinertzhagen says that the Moustached Sedge-Warbler was found in the marshes of Danaghori where a few were seen and the distinctive song was often heard in the dense reed-brakes. The organs of the bird shot suggested breeding.

St. John's pair collected at Kandahar on 20 April may have been on passage.

Locustella nœvia mongolica Sushkin.

Specimen collected.—♂ 23 April 1937 Bamian (Meinertzhagen).

Locustella nœvia straminea Seebohm.

Specimens collected.—4 ♂ 20-24 April 1937. Bamian 8,500 ft. (Meinertzhagen).

'These birds appeared during the rush of migrants at Bamian in April but never more than one a day. In fact for seven consecutive days we saw a single bird on each occasion' (Meinertzhagen). These are the only records of the Grasshopper Warbler in Afghanistan.

Locustella certhiola centralasiæ Sushkin.

Specimen collected.—♂ 19 April 1937 Bamian (Meinertzhagen).

Locustella certhiola rubescens Blyth.

Specimens collected.—2 ♂ 24-25 April 1937 Bamian (Meinertzhagen).

All these specimens of the genus *Locustella* were compared and identified by Meinertzhagen in the Academy of Sciences at Leningrad. They provide the only records for Afghanistan.

Cettia cetti cettioides Hume.

Specimens collected.—♂ 13 January 1881 Kandahar (Swinhoe); 2 sex? 20-22 Feb. Chahar Shamba (Yate).

These 3 specimens of Cetti's Bush-Warbler provide the only records for Afghanistan. Swinhoe's bird was shot in the ditch full of rank growth just outside the city wall.

Scotocerca inquieta striata (Brooks).

Specimens collected.—♂ ♀ 11-19 April 1885 Tirphul (Aitcheson); ♂ 6 April Kabul 6,000 ft., ♂ 29 April Doab 6,000 ft., 2 ♀ 16 May 1937 Haibak 3,000 ft. (Meinertzhagen).

The Streaked Scrub-Warbler seems to be rare and local in Afghanistan. In addition to the localities suggested by the above records St. John met it at Kandahar. One of the females collected at Haibak by Meinertzhagen on 16 May contained a soft egg. A resident species.

Hippolais caligata caligata (Licht).

Specimen collected.—♂ 30 August 1933 Kabul 5,700 ft. (Maconachie).

The above specimen was no doubt on passage, St. John states that the Booted Tree-Warbler is common in suitable localities in the Kandahar area, but the only specimen of his which I can trace in the British Museum, namely ♂ 18-6-1880 Kandahar, is so damaged as to be quite unrecognisable, as between the two races.

Hippolais caligata rama (Sykes).

Specimens collected.—♀ 23 June 1875 Kandahar (St. John); ♂ 1 May 1881 Gungazai (Swinhoe); 2 sex? 22 April-13 May Kila Wali, sex? 18 May Darband-i-Kil Rekhta (Yate); ♂ 2 May 1937 Doshi 2,750 ft. (Meinertzhagen).

Sykes' Tree-Warbler is probably a summer visitor to the greater part of Afghanistan. Meinertzhagen says that it was breeding at Doshi where it was fairly common in the fruit trees, especially the mulberry. Yates' specimens from Murghab in April and May were no doubt also on their breeding ground. Swinhoe obtained his specimen at Gungazai on 1st May from a pair which had an unfinished nest in the riverbed. St. John states that this species is not uncommon all over the Kandahar area. This may be the bird which Cumming (p. 687) records under the name of *Hippolais obsoleta* as frequently seen in the low bushes of the 'dasht' near the Rud-i-Seistan. He shot specimens in March and April near Kuhak but I have been unable to trace them.

Hippolais languida (Hemprich & Ehrenberg).

Specimens collected.—2 ♂ 2 ♀ 3 May 1885 between Kambao and Shore Kaltegai (Aitcheson).

These specimens provide the only record of Upcher's Warbler in Afghanistan.

Hippolais pallida elæica (Lindermayer).

Specimens collected.—2 sex? 2 June Jalaiar, Maimanah (Yate); ♂ 12 May 1937 Haibak 3,000 ft. (Meinertzhagen).

Meinertzhagen says that the Olivaceous Warbler was clearly breeding at Haibak, where a few pairs were seen, and this no doubt was also the case at Jalaiar. Presumably a summer visitor only.

Sylvia nisoria (Bechst.).

Specimens collected.—♀ 14 May 1885 Kumani-bhest, Hari-Rud (Aitcheson); ♂ 7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

Status uncertain. Aitcheson has left no details of his bird and Meinertzhagen says that his specimen was the only one observed. It was not singing but skulking in a small willow by the banks of a dry water-cut. The organs were not sufficiently enlarged for breeding.

Sylvia mystacea Ménétries.

Specimens collected.—♂ 23 March 1885 Gulran (Aitcheson); sex? 22 April Kila Wali, sex? 2 June Jalaiar (Yate); 21 March 1905 Kuhak (Cumming).

There are no other records of Ménétries' Warbler in Afghanistan. Cumming found this species (which he recorded under the name of *Sylvia jerdoni*) fairly common in the tamarisk jungles fringing the Helmund. By the courtesy of Dr. Baini Prashad I have been able to examine Cumming's specimen in the Indian Museum and confirm its real identity.

Sylvia nana nana (Hemprich and Ehrenberg).

Specimens collected.—2 ♂ 12 March, ♂ 19 March 1885 Gulran, ♂ 11 April 1885 Tirphul (Aitcheson).

The only records of the Desert Warbler in Afghanistan.

Sylvia hortensis crassirostris Cretzschmar.

Specimens collected.—♀ 1 May 1885 Kambao, ♂ 14 May 1885 Nihal-Shani (Aitcheson); 2 ♀ 12 April Ghorband 6,500 ft., ♂♀ 23-24 April 1937 Bamian 8,500 ft. (Meinertzhagen).

Meinertzhagen says that his specimens of the Orphean Warbler were on passage and were all he saw except for a male at Doab on 28 April which was in some scrub on a steep hillside and may have been in its breeding quarters. Aitcheson's specimens were also probably on their breeding ground.

I have seen none of the above specimens and take the subspecific identification from Meinertzhagen.

Sylvia althœa Hume.

Specimens collected.—♂ 2 May 1879, ♂ 26 May 1879, ♂ 27 May 1879 Byan Khel (Wardlaw-Ramsay); ♂ 18 June 1933 Chahiltan 5,900 ft. (Maconachie).

Hume's Whitethroat was recorded under the name of *Sylvia affinis* by Wardlaw-Ramsay as breeding in large numbers in the Hariab Valley about Byan Khel 7,000 ft. in the latter end of May. It arrived after the beginning of the month. Maconachie's specimen from Chahiltan also appears from the date and its enlarged organs to have been on its breeding ground.

Sylvia curruca minula Hume.

Specimens collected.—♀ 16 April 1881 (Swinhoe) ♀ 19 March Gulran, 3 ♂ 6-12 April Tirphul; ♀ 26 April Khusan, ♀ 26 April 1885 Tirphul (Aitcheson); sex? 13 March Maruchak (Yate); ♂ 21 April 1937 Bamian (Meinertzhagen).

The above specimens furnish the whole of our information about the Lesser Whitethroat in Afghanistan.

Sylvia curruca blythi Ticehurst & Whistler.

Specimens collected.—2 sex? 28 April—1 May Chahar Shamba (Yate); sex? 30 April 1933 Ghorband Valley 5,000 ft., ♂ 24 Sept. 1933 Paghman 7,500 ft.; 2 ♀ 13 May 1934 Chahiltan 5,900 ft., sex? 27 May 1934 Baqrami 5,700 ft., sex? 22 Sept. 1936 Ashraf Valley 4,200 ft. (Maconachie); 9 ♂ 20-24 April 1937 Bamian 8,500 ft. (Meinertzhagen).

Meinertzhagen says that the Lesser Whitethroat was common in the Ghorband Valley between 7,500 ft. and 8,500 ft. in mid-April and at Bamian on 21 April. On the 22nd prodigious numbers arrived which had all gone again on 24 April. A single bird was subsequently observed at Doab 5,000 ft. on 29 April. The other specimens enumerated above were also presumably on passage.

St. John states that he obtained a specimen at Kandahar which was identified by Hume but I have been unable to find this skin in the British Museum.

Sylvia curruca halimodendri Sushkin.

Specimens collected.—♂ 15 April Ghorband 6,500 ft., 3 ♂ 23 April Bamian 8,500 ft., 2 ♂ 29 April Doab 5,000 (Meinertzhagen).

Meinertzhagen says that the above birds were all on passage.

[**Phylloscopus tytleri** Brooks.

There seems to be no authority for the statement in the *New Fauna* (vol. ii, p. 456) that Tytler's Willow-wren occurs in Afghanistan].

Phylloscopus collybita tristis Blyth.

Specimens collected.—Sex? Pashat (Griffith); ♀ 26 April 1879 Byan Khel (Wardlaw-Ramsay); ♀ 28 January, 3 ♂ 30 March, ♂ 31 March, ♂ 27 December 1879 Kandahar, sex? 5 Oct. 1879 Khelàt-i-Ghilzai (St. John); ♂ 3 January, ♂ 2 April 1881, Kandahar (Swinhoe); ♀ October 1884, banks of R. Helmund, ♂ 12 April, ♀ 26 April 1885 Khusan (Aitcheson); ♂ 17 April Kabul, sex? 5 April Baqrami, ♂ ? 2 December 1933 Chahiltan 5,900 ft., sex? 14 March Chaharasia 5,700 ft., sex? 19 March Chahiltan 5,900 ft., ♀ 2 May 1934 Kabul 5,700 ft. (Maconachie); ♂ 7 April Kabul 6,000 ft., ♂ 9 April Paghman 8,000 ft., sex? 15 April Ghorband 6,500 ft., ♂ 2 May Doshi 2,750 ft., ♂ 7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

At Kandahar the Siberian Chiffchaff is a common winter visitor according to St. John and Swinhoe. Meinertzhagen says it was quite common round Kabul in early April and later on he found it everywhere and at almost all elevations but not at Haibak or Kunduz. These birds were presumably on passage.

Phylloscopus collybita sindianus Brooks

Specimen collected.—♂ 15 April Ghorband 6,500 ft. (Meinertzhagen).

Ticehurst (*Systematic Review of the Genus Phylloscopus*, p. 57) considers that this is probably the breeding form of N. Afghanistan where Meinertzhagen flushed a Chiffchaff from an empty nest in the Ghorband Valley on 24 May. Ticehurst also records a winter specimen from Helmund on the border of S. Afghanistan and Persia.

Phylloscopus griseolus Blyth.

Specimen collected.—♂ 16 May, ♂ 28 June 1879 Byan Khel (Wardlaw-Ramsay); 4 ♂ 17-18 April Ghorband 8,200 ft. (Meinertzhagen).

Wardlaw-Ramsay states that the Olivaceous Willow-Warbler was common and breeding in May and June in the Hariab Valley 7,000-8,000 ft. Whitehead says that it nests freely on parts of the Safed Koh just over the border.

Meinertzhagen says.—'Fairly common in the Ghorband Valley in mid-April, almost always found on rock-faces or walls and shy. Also seen at Bamian at 9,000 ft. on rocks on 20 April and a good many at Doab, always on rocks at considerable elevations, at 7,000 ft. and above, at the end of April.'

Phylloscopus schwarzi (Radde).

Specimen collected.—♂ 6 May 1937 Danaghori (Meinertzhagen).

Shot in reeds. The only record of Radde's Bush-Warbler in Afghanistan.

Phylloscopus trochiloides nitidus Blyth.

Specimens collected.—♂ 18 April, ♂ 30 October 1879 Kandahar (St. John); ♂ 26 April Akrobart, sex? 2 May 1937 Doshi 2,750 ft. (Meinertzhagen).

A specimen of the Green Willow-Warbler was procured by Aitcheson somewhere in Northern Afghanistan but unfortunately the data was lost. In addition to the above specimens obtained Meinertzhagen thought he saw a pair in the Doab orchards on 29 April and a few at Haibak on 12 May in the gardens. These records all doubtless refer to passage birds.

Phylloscopus trochiloides viridanus Blyth.

Specimens collected.—♂ 30 April 1933 Ghorband Valley 5,000 ft. ♂ 20 April 1934 Kabul (Maconachie).

The two specimens of the Greenish Willow-Warbler collected by Maconachie provide the only information about this species in Afghanistan.

Phylloscopus inornatus humei (Brooks).

Specimens collected.—Sex? Pashat (Griffith); 2 sex? 14-23 April Panjab, Wakham (Biddulph).

These are the only records of Hume's Willow-Wren for Afghanistan but Whitehead says it breeds in large numbers on the Safed Koh from 7,000 ft. to 4,000 ft. Unfortunately he preserved no specimens in verification.

Phylloscopus subviridis (Brooks).

Specimens collected.—2 ♂ 24 April, ♂ 5 May, ♀ 20 May, ♂ 21 May 1879 Byan Khel (Wardlaw-Ramsay).

Wardlaw-Ramsay found Brook's Willow-Wren common in the Hariab Valley 7,000-8,000 ft. and it was evidently breeding there as the males had enlarged testes and a female shot on 20 May contained eggs ready for laying. Whitehead says that it nests freely on the Safed Koh from 7,000-9,000 ft.

Phylloscopus neglectus neglectus Hume.

St. John states that he obtained a specimen of the Plain Brown Willow-Wren at Kandahar. I have not traced the skin in the British Museum but the identification was confirmed by Hume.

Phylloscopus occipitalis occipitalis (Blyth).

Specimens collected.—sex? 28 June 1879 Byan Khel (Wardlaw-Ramsay).

This specimen—which had been labelled *viridanus* and *plumbeitarsus*—shows that the Large Crowned Willow-Wren breeds on the Afghan side of the boundary of the Safed Koh where Whitehead says it is the commonest member of the genus breeding from 6,000-10,000 ft.

Koelz has named a new race *Phylloscopus occipitalis kail* (Proc. Biol. Soc. Washington col. 52 (5 June 1939) p. 71) from specimens taken by him at Kail, Daulatshah, Gumandru, Sanglech and Iskarzir in Northern Afghanistan. The differences alleged are not however satisfactory.

[**Phylloscopus pulcher kangræ** Ticehurst.

I can find no authority for the statement in the *New Fauna* (vol. ii, p. 465) that the Orange-barred Willow-Wren occurs in Afghanistan.]

[**Phylloscopus magnirostris** Blyth.

Whitehead found the Large-billed Willow-Wren breeding on the lower slopes of the Safed Koh from 7,000 ft. to 8,000 ft. so it should occur just within our boundaries.]

[**Phylloscopus proregulus simlaensis** Ticehurst.

Whitehead found Pallas' Willow-Warbler in summer on the Safed Koh at 8,500 ft. so it should breed within the Afghan boundary.]

[**Seicercus xanthischistos albosuperciliaris** (Jerdon).

Recorded from Afghanistan in the *New Fauna* (vol. ii, p. 491) but I have seen no evidence that it occurs.]

Prinia gracilis lepida Blyth.

Specimens collected.—♂ 2 October 1904 Kuhak (Cumming) ♂ 10 March 1896 Samuli 4,500 ft. (Maynard).

Cumming found the Streaked Wren-Warbler fairly common in the tamarisk jungles of Seistan and found a nest with 4 eggs at Kuhak on 29 March 1904. Maynard collected a bird at Samuli on the Afghan-Baluch frontier on 10 March 1896. A resident species.

[**Regulus regulus himalayensis** Jerdon.

According to Whitehead the Goldcrest is fairly numerous in summer amongst the firs and deodars of the Safed Koh from 8,000 ft. to 11,000 ft. so it must occur on the Afghan side of the border. I presume these birds belong to the Himalayan race.]

Regulus regulus tristis Pleske.

Specimens collected.—sex? 21 November, sex? 2 December 1933 Chahiltan 5,900 ft. (Maconachie).

These specimens provide the only records of this race of the Goldcrest in Afghanistan. It is presumably a winter visitor only.

[**Cephalopyrus flammiceps** (Burton).

I can find no authority for the statement in the *New Fauna* (vol. ii, p. 545) that the Fire-cap occurs in Afghanistan.]

Pastor roseus (Linnaeus).

Specimens collected.—♂ Otipore, 2 sex? Kabul (Griffith); ♂ ♀ 24 April, 18 July 1879 Kandahar (St. John); 3 ♂ 2 ♀ 13 April 1885 Tirphul (Aitcheson); 2 sex? 14 April Karawal Khana (Yate); ♂ 6 July 1933 Tala 3,700 ft. (Maconachie); 4 ♂ 20 April 1937 Bamian 8,500 ft. (Meinertzhagen).

The Rosy Pastor appears to be only a passage migrant through Afghanistan on its way to and from India. In earlier days observers in India thought—from the greatly enlarged testes of the males in spring and the early date on which old and young birds returned to India—that there must be some breeding place in Afghanistan but there seems no reason now to believe that this is the case.

On the autumn passage this is one of the earliest migrants to arrive. Maconachie's specimen shot at Tala on 6 July furnishes the earliest date but we have no other information about this passage except St. John's statement that at Kandahar the return swarms begin to make their appearance early in August at latest and have not entirely passed until the beginning of October.

In the spring the first returning flocks reach Kandahar towards the end of March, according to Swinhoe, but more usually early in April, according to

St. John. There is no other information about S. Afghanistan and it may well be that the flocks which pass through Kandahar strike in a north-westerly direction to avoid the deserts around the Helmund. The birds arrive in Afghanistan on a broad front, however, as whilst they are in Kandahar others pour through the country about Kabul and north of the Hindu Kush.

Meinertzhagen first met with 4 males in full breeding dress at Bamian on 20 April. After this he met further stragglers on 24 April at Bamian, and on the 27 and 28th April at Doab. Then at Doshi on 1st and 3rd May some large flocks were seen travelling. He met the main migration, however, at Danaghori between the 4th and 10th of May and estimated that there must have been close on half a million on the Danaghori Plains during the first week of May. Many birds roosted in the reed beds. On the 11th May there were many large flocks passing north towards Haibak and for the following week many large packs were seen at Haibak and again at Kunduz. On the return journey Meinertzhagen saw a few at Doshi on 22 May and a few near Kabul on 26 May. In describing this interesting experience he gives the direction in which the flocks were travelling as north and north-west.

As Aitcheson occasionally met huge flocks over the whole of Badghis and the Hari-Rud Valley one is justified in assuming that the Pastor traverses the whole of Afghanistan north of the Hindu Kush. Aitcheson collected 5 specimens at Tirphul on 13 April which is rather earlier than Meinertzhagen's experiences.

It is perhaps worth emphasising the fact that the Rosy Pastor affords one of the most remarkable east to west migrations that is known. It leaves India on the restricted front between the foot of the Himalayas and Central Baluchistan, travels over the high ground of Northern Baluchistan, Central and Northern Afghanistan and Persian Khorasan to the S.-E. corner of the Caspian, a route which allows it to miss the wide deserts and low-lying plains of S.-E. Afghanistan and Central and Southern Persia where such vast numbers of a voracious species would be hard put to it to procure sufficient food.

According to Meinertzhagen the Afghans regard the Pastor as beneficial to agriculture and do not molest it in spite of the damage which it does to the ripe mulberries in spring.

Acridotheres tristis tristis (Linnaeus).

Specimens collected.—♂ Pashat sex? Jalalabad (Griffith); ♂ 15 August 1933 Kabul (Maconachie); ♂ 8 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The Common Mynah occurs sparingly round villages between the Khyber Pass, Jalalabad and Kabul and is resident. Near Kabul Meinertzhagen found them quite at home in snow in early April and some were seen at 8,500 ft. in the Paghman Valley on 27 May and at Charikar on 26 May. At Danaghori he met but a single pair in early April (the male of which was secured and seemed rather pale compared with Punjab birds) but at Haibak and Kunduz they were more common and breeding in mid-May.

Acridotheres ginginianus (Latham).

Specimen collected.—sex? Kandahar (Griffith).

This Griffith specimen in the British Museum provides the only record of the Bank Mynah in Afghanistan, but I think the record may be accepted, as a straggler, for the species occurs in the Peshawar, Kohat and Bannu districts.

Temenuchus pagodarum (Gmelin).

Specimens collected.—Juv. Kabul; sex? Baber's garden, Kabul (Griffith); ♀ 4 June 1933 Kabul (Maconachie).

Meinertzhagen saw a few Brahminy Mynahs in the gardens of Jalalabad on 31 May. Here and at Kabul it is doubtless a summer visitor, as in Gilgit. Wardlaw-Ramsay saw a flock in the Hariab Valley at 7,000 ft. in some willow trees which were doubtless on passage, as he suggests, for he never saw them again. Koelz has given the name *T. p. afghanorum* (Proc. Biol. Soc. Washington, vol. 52 (5 June 1939) p. 73) to Afghan birds on the strength of specimens he collected at Tagan, Mamakhal and Chandau, but I could not separate Maconachie's bird from an Indian series.

[**Sturnus vulgaris humii** Brooks.

Said in the *New Fauna* (vol. iii, p. 32) to breed in Afghanistan, but I have seen no evidence to this effect.]

Sturnus vulgaris porphyronotus Sharpe.

Specimens collected.—sex? 20 October 1839 Kabul, sex? 1840 Jalalabad (Griffith).

Sturnus vulgaris poltaratzskyi Finsch.

Specimens collected.—sex? Kanadahar (Griffith); 2 November 1933 Vagrami 5,700 ft. (Maconachie).

Sturnus vulgaris nobilior Hume.

Specimens collected.—sex? Arghundab (Griffith); 2 ♂ 1 ♀ 12-13 May 1937 Haibak 3,000 ft. (Meinertzhagen).

Meinertzhagen records that *S. v. nobilior* (of which the type locality is Kandahar) was found breeding at Haibak and Kunduz but not elsewhere and that it was not common. In Haibak he did not see more than a few pairs in a week and they appeared to have young on 11 May. At Kunduz they had clamouring young on 20 May. At Kunduz the only nests seen were high up in plane trees but at Haibak there were nests in semi-ruined houses as well as in holes in mulberry trees.

Owing to the war I have been unable to examine the specimens of starlings from Afghanistan in the British Museum. It is evident, however, from Hutton, Swinhoe and St. John, Aitcheson, Cumming and Annandale that the starling in various races is an abundant winter visitor and passage migrant throughout the greater part of Afghanistan. According to Hutton some race breeds at Kandahar in April and May but Swinhoe and St. John do not confirm this.

Oriolus oriolus kundoo Sykes.

Specimens collected.—sex? Pashat (Griffith); ♀ 5 June 1933 Kabul (Maconachie); 2 ♂ 2 ♀ 7-9 May 1937 Danaghori (Meinertzhagen).

The Golden Oriole is a summer visitor to Afghanistan but it has so far only been recorded in the eastern half of the country.

Meinertzhagen first met with it on the 7th May at Danaghori where the first pair arrived on the previous night. By 9 May they were fairly common, a pair being found in most orchards. At Doshi, Haibak and Kunduz they were also fairly common and were breeding and on the return journey they were found to be well distributed in the Ghorbund and Paghman valleys, and at Kabul and Jalalabad.

In the Hariab valley at 7,000-8,000 ft. Wardlaw-Ramsay considered the Golden Oriole extremely rare but at Kandahar according to St. John, it is abundant in the orchards and plantations. Here too it arrives about the beginning of May.

[**Uroloncha malabarica** (Linn).

In the *New Fauna* (vol. iii, p. 90) the White-throated Munia is stated to occur in Afghanistan but I have found no evidence to that effect.]

Coccothraustes coccothraustes humii Sharpe.

A specimen of the Hawfinch was evidently obtained by Griffith on 21 April 1839 at the 'Khossik Pass', as appears from a MSS. list of birds forwarded to the British Museum by the ship *Worcester*, but the specimen can no longer be traced. Whitehead met with a party on 5 May at 9,000 ft. on the Peiwar Spur and the bird is well known to be a winter visitor to Attock, Rawalpindi and the Kala Chitta range and the Kohat district. It must therefore occur fairly commonly somewhere in Afghanistan but the breeding range has not so far been discovered.

Perissospiza icterioides (Vigors).

Specimen collected.—♂ 20 June 1879 Peiwar Kotal (Wardlaw-Ramsay).

Whitehead found the Black and Yellow Grosbeak breeding commonly on the slopes of the Safed Koh from 7,000-11,000 ft. and Wardlaw-Ramsay's specimen suggests that this is doubtless also the case on the Afghan side of the boundary.

Mycerobas carnipes speculigera Brandt.

Specimens collected.—♂ ♀ 30 April 1879 Byan Khel (Wardlaw-Ramsay).

These specimens were collected by Wardlaw-Ramsay in the pine forest and here again no doubt the Afghan status of the species is illuminated by the fact that Whitehead found it breeding on the Safed Koh from 8,000-12,000 ft. on the Kurram side.

[**Mycerobas melanoxanthus** (Hodgson).

There appears to be no evidence to support the statement in the *New Fauna*, (vol. iii, p. 106) that the Spotted-winged Grosbeak occurs in Afghanistan].

[**Loxia curvirostris** Linnaeus.

Our only information about the Crossbill is contained in Blyth's statement (apud Hutton, p. 779) that he had seen skins as well as a living specimen from Afghanistan. Unfortunately further details are lacking].

[**Carpodacus thura blythi** (Biddulph).

The White-browed Rose-Finch must breed in Afghanistan as Whitehead found it not uncommon on the Safed Koh in summer from 8,000-11,000 ft. Young were on the wing by the 29 June].

Carpodacus rhodochlamys grandis Blyth.

Specimens collected.—♂ Pashat (Griffith); ♂ 20 June 1879 Peiwar Kotal (Wardlaw-Ramsay).

Apart from the specimen collected by Griffith and now in the British Museum, Wardlaw-Ramsay shot the male of a pair of Red-mantled Rose-finches in pine forest at 8,800 ft. on the Peiwar range. They were doubtless breeding there as Whitehead found them on the Safed Koh in July between 10,000 ft. and 11,000 ft.

Carpodacus erythrinus roseatus (Blyth).

Specimens collected.—♂ Afghanistan (Griffith); ♂ 24 June Shaluzan, ♂ 28 June 1879 Byan Khel (Wardlaw-Ramsay); 4 ♂ 1 ♀ 9-14 April Kandahar, ♀ 3 May 1881 Syed Yarroo (Swinhoe); 4 ♂ 16-26 April Khusan, ♀ 26 April Tomam-Agha, ♀ 18 May, 1885 Simkoh Badghis (Aitcheson); 2 ♂ 17 April Ghorband 8,200 ft., 3 ♂ 23 April Bamian 8,500 ft., ♂ 28 April Doab 5,000 ft., ♀ 18 May Baghlan 2,000 ft., ♀ 13 May Haibak 3,000 ft., 2 ♂ 24 May Ghorband 8,300 ft., ♂ 25 May 1937 Shibar Pass 9,800 ft. (Meinertzhagen).

The Common Rosefinch is a summer visitor to Northern Afghanistan, Meinertzhagen met with the first arrivals, two males, at Ghorband on 17 April and after that date he saw them frequently at every camp down to the Oxus Valley at Haibak and Kunduz. As Aitcheson found them very common at Kusan in April (his first specimen was obtained on the 16th) it seems probable that this species breeds throughout the whole of Northern Afghanistan above the Hindu Kush. As it breeds on the Safed Koh from 6,500 ft. to 8,500 ft. on the Kurram side of the boundary it is also doubtless a breeding bird on the same range in Afghan territory but in the Hariab Valley Wardlaw-Ramsay only seems to have met with it on passage as he saw small parties there occasionally in May and the early part of June.

At Kandahar St. John says quite definitely that it is a passage migrant both in spring and autumn and on the spring passage Swinhoe saw the first flock on 9 April.

Meinertzhagen attributes his series of breeding birds to the race *kubanensis* but Ticehurst has given reasons (*J.B.N.H.S.*, xxxii, 345) for not accepting this intermediate race and with them I am in agreement.

Carpodacus rubicillus severtzovi Sharpe.

Specimens collected.—sex? 13 April 1874, ♂ 19 April 1874 Panjah (Biddulph).

Colonel Biddulph states that Severtzov's Rosefinch was common in Wakhan at 9,000 ft. on both his journeys through that tract.

Koelz obtained a pair of these finches to which he gave the name *Erythrina rubicilla diabolica* (Proc. Biol. Soc. Washington, vol. 52 [5 June 1939] p. 75) at Sanglech on 27 July 1937. He describes it as intermediate between typical *rubicillus* and *severtzovi*.

Carpodacus synoica sálimalii Meinertzhagen.

Specimens collected.—♂ 19 April Shibar Pass 8,000 ft., 7 ♂ 4 ♀ 22-23 April Bamian 8,500 ft. 2 ♂ 1 ♀ 26 April 1937 Akrobat 9,000 ft. (Meinertzhagen).

This new race of the Sinai Rose-finch was one of the great discoveries of Meinertzhagen's journey to Afghanistan. It was first seen at the western foot of the Shibar Pass at a spot where the pink sandstone of the Bamian Valley first shows itself. To quote his graphic words.—'The rose-red rock reminded me of Petra and the Sinai Rose-finch, on which my mind was dwelling, when Sálim Ali drew my attention to a pink bird sitting on a stone wall. That was our first introduction. At Bamian they were not uncommon in mixed parties, sometimes with *Petronia*, in bare rocky valleys and often sitting on bare earth cliffs, flying out to feed on early crops in the valley. The blending of the colour of both male and female with surrounding rocks was perfect and without movement detection would be most difficult. Birds were feeding on newly-sown grain.'

'In the Akrobat Pass birds were associating with *Passer domesticus* in similar bare rocky valleys and slopes. They were also observed up to 11,000 ft. among snow in the hills north of Bamian.'

This species must certainly be resident in this area.

Bucanetes githagineus crassirostris (Blyth).

Specimens collected.—♂ Kandahar (Hutton); ♀ 4 Oct. 1879 Kelat-i-Ghilzai (St. John); ♀ 3 February 1881 Kandahar (Swinhoe); ♂ 20 April Kabul, ♀ 20 June Ghazni road, 2 ♂ adult 2 juvs. 1 July 1934 Chakri Minar 8,200 ft. (Maconachie); ♂ 2 ♀ 15 May 1937 Haibak 3,000 ft. (Meinertzhagen).

These specimens provide the only records of the Trumpeter Bullfinch in Afghanistan but the country is eminently suited to its habits and the bird itself is very easy to overlook so it is probably commoner and more widely spread than these records suggest. Meinertzhagen found them breeding at Haibak in desolate gorges using holes in the rock-faces and Maconachie's two juveniles from Chakri Minar were doubtless hatched in that neighbourhood.

Bucanetes mongolicus (Swinhoe).

Specimens collected.—2 ♀ 20 April 1874 Panjah (Biddulph).

Biddulph states that the Mongolian Desert Finch was very common in Wakhan in April.

Chloris chloris smithæ Koelz.

Specimens collected.—2 ♂ 2 ♀ 1 December 1937 Kalkh (Koelz.)

The above specimens on which Koelz based his new form *smithae* (Proc. Biol. Soc. Washington, vol. 52 [5 June 1939] p. 74) provide the only records of the Greenfinch in Afghanistan.

Rhodospiza obsoleta (Lichtenstein).

Specimen collected.—♂ 3 October 1879 Khelat-i-Ghilzai (St. John); ♂ Dec. 1880, ♂ 23 January, ♂ 2 February, ♂ 30 March, ♂ 31 March ♂ 1 April 1881 (Swinhoe); ♀ 16 April 1885 Khusan (Aitcheson); 2 sex? 27 March Khwaja Gogirdak (Yate).

The above records provide the only information about the status of Lichtenstein's Desert Finch beyond the fact that St. John and Swinhoe considered it a winter visitor to the gardens of Kandahar where it was often in their time netted and brought in for sale. Swinhoe says it was not observed there later than 1st April.

Rhodopechys sanguinea sanguinea (Gould.).

Specimens collected.—♂ Pashat (Griffith); 3 ♂ 9 sex? 14-25 April 1874 Panjah (Biddulph); ♂ 24 May Ghorband 8,300 ft., 4 ♂ 25 May 1937 Shibar Pass 9,000-9,800 ft. (Meinertzhagen).

According to Horsfield and Moore (vol. ii, p. 461) Griffith observed the Crimson-winged Finch at Pashat in small flocks. Biddulph's note on his specimens is as follows:—'We met with this only at Panjah in Wakkan, in April—and there we only saw one large flock which used to come every morning and settle on some bare ground near our camp, until we had shot most of them. The elevation of the place at which we shot them was 9,000 ft.'

Meinertzhagen only met with the bird on the Shibar Pass and in the Ghorband Valley. Although they were often in small parties of five and six, their organs showed that they were ready to breed.

Carduelis caniceps paropanisi Kollibay.

Specimens collected.—sex? Kabul (Griffith); ♂ 21 May 1879 Byan Khel (Wardlaw-Ramsay); ♂ 24 Nov. 1879 Kandahar (St. John); ♂ 1 January 1881 Kandahar (Swinhoe); sex? March Andkhui (Yate); ♂ juv. 18 June 1933, Chahiltan 5,900 ft. (Maconachie); 2 ♂ 7 April Kabul, (Meinertzhagen); 2 ♂ 3 ♀ 22 April Bamian, ♂ 24 May 1937 Ghorband (Meinertzhagen).

The Goldfinch is apparently not a common bird in Afghanistan, except on the eastern border where Wardlaw-Ramsay found it not uncommon in the Hariab Valley 7,000-8,000 ft. and noted it as associating with Serins; and at Kandahar where according to Hutton and St. John it is common in winter and spring but does not breed in the neighbourhood.

From the rest of the country it has only been recorded from the country round Kabul where Griffith obtained it and Meinertzhagen met with a flock near snow, 10 miles south of the town, on April 7th and at Chahiltan 7 miles S.-W. of Kabul where Maconachie obtained a young bird on 18 June which must surely have been bred in the neighbourhood; from Bamian where Meinertzhagen met a large flock on 22 April feeding on bare hill slopes and roosting in poplars; from the Ghorband Valley where Meinertzhagen found a few pairs breeding in late May; and finally from Andkhui in the Oxus Valley where Yate obtained a bird in March.

Some birds doubtless breed on the Safed Koh above the Hariab Valley and these may perhaps belong to the typical race. Meinertzhagen attributes 8 of his specimens to the race *paropanisi*. I had previously examined five of the other specimens listed and attributed them to the same race on their length of bill (18.5 m.m.) though I am not quite satisfied that it is worth separation from *caniceps*. The Goldfinch is a very favourite cage bird with the Afghan.

Carduelis caniceps subulata (Gloger).

Specimen collected.—♂ 22 April 1937 Bamian 8,500 ft. (Meinertzhagen). Meinertzhagen attributes to this form one specimen shot from the flock of the previous race which he met at Bamian. It is slightly larger (wing 85 mm.) and paler than the other birds.

[**Callacanthis burtoni** (Gould).

Whitehead found the Red-browed Finch not uncommon in summer on the Safed Koh from 8,000-9,000 ft. so it must occur within the boundaries of Afghanistan.].

Acanthis flavirostris subsp.?

Specimens collected.—♂ ♀ 4 unsexed 24 April 1874 Panjah, Wakhan (Biddulph); ♂ ♀ 8 April Paghman 8,000 ft. 4 ♂ 3 ♀ 24 April Ghorband 8,300 ft., 3 ♂ 2 ♀ 25 April Shibar Pass 9,000 ft., ♀ 29 May 1937 Unai Pass 12,000 ft. (Meinertzhagen).

Biddulph found the Twite particularly common, generally in small dispersed parties, at Panjah on 24th April 1874 but this series I have not seen.

Meinertzhagen also obtained Twites in Afghanistan but his series is too worn to be identified with certainty though they agree with *korejewi* in similar plumage. He says 'Occasional flocks among the snowfields in the Paghman Valley in early April but very shy. Not met with again until we crossed the Shibar Pass on 23 May when we found them abundant, though not yet breeding. They were still in small mixed flocks. In the Ghorband Valley between 8,400 ft. and 10,000 ft. the same remarks apply for the last week in May.

Acanthis cannabina fringillirostris (Bp. and Schleg).

Horsfield and Moore (Cat. Ind. Mus. ii, p. 496) list a male linnet from Afghanistan in the Griffith collection and the *Worcester* MSS. list mentions a specimen as collected by Capt. Hay.

Serinus pusillus (Pallas).

Specimens collected.—2 ♂ 1 ♀ Pashat (Griffith); 2 ♂ 1 ♀ Kandahar (Hutton); ♂ 25 April 1874 Panjah (Jordan); ♂ ♀ 6 November 1879 Byan Khel (Wardlaw-Ramsay); ♂ 10 April 1881 Kandahar (Swinhoe); ♂ 23 July 1933, Khinjan Pass 8,800 ft. (Maconachie); ♂ 12 April Paghman 8,000 ft., 1 ♂ 2 ♀ 28 April 1937 Doab 5,000 ft. (Meinertzhagen).

The Gold-fronted Finch certainly breeds along the eastern border of Afghanistan as Wardlaw-Ramsay found it plentiful in the Hariab district in flocks until the early part of June when it commenced to breed. He found a nest with one egg on the Peiwar range and later Whitehead found it fairly common in the same area in summer between 8,000 ft. and 9,000 ft. Maconachie's July specimen from the Khinjan Pass suggests that it may also breed in the mountains round Kabul.

Out of the breeding season it is doubtless not uncommon in a wider area. Griffith obtained specimens at Pashat and noted it in his journal as seen at Bharowal on 7 March 1840. He says that it was found in flocks in cultivation feeding on thistles. Meinertzhagen found a few small parties in the Paghman Valley in early April at about 8,200 ft. and a flock of 10 birds feeding on seeds of *Sisymbrium* at Doab on 28 April.

Swinhoe's Kandahar specimen was a caged bird, evidently freshly caught, and he was informed by the bird-catchers that it occurred in flocks from the middle of April to the middle of September, but as St. John points out, the bird can hardly breed about Kandahar and these dates—if based on anything but imagination on the part of the bird-catchers—must refer to passage movements. Hutton's specimens probably also came from the bird-catchers.

Fringilla montifringilla Linnaeus.

Specimens collected.—2 ♂ Afghanistan, ♀ Otipore ♀ Pashat (Griffith); ♂ 18 April 1874 Panjah (Biddulph); ♂ 8 January 1880 Kandahar (St. John); ♂ ♀ 21 November, ♀ 2 December, ♀ 9 December 1933 Chahiltan 5,900 ft. (Maconachie).

In addition to the above specimens, Meinertzhagen records seeing a small flock of Bramble-Finches at Kabul 5,800 ft. on 6 April and another large flock migrating north at 11 a.m. on 24 April at Bamian 8,500 ft. Murray says that a Mr. Hutchings had four males and one female from Abdul Rahman and Mandi Hissar near Kandahar.

Passer domesticus griseigularis Sharpe.

Specimens collected.—♂ Afghanistan 2 ♀ Pushut, ♀ Dadur (Griffith); ♂ 9 May 1879 Byan Khel (Wardlaw-Ramsay); ♂ 11 April, ♂ 27 April 1879 Kandahar (St. John); 2 ♂ 6 April, 2 ♂ 8 April, ♂ 9 April, 4 ♂ 3 ♀ 16 April 1881 (Swinhoe); 4 ♂ 15 April Karawal Khana (Yate); 3 ♂ 16 April Khusan, ♀ 20 April ♀ 25 April 1885 Tirphul (Aitcheson); ♀ 9 August 1933 Kabul (Maconachie); 8 ♂ 3 ♀ 23-26 April Bamian 8,500 ft., ♂ 1 May Barfak 3,500 ft., ♂ 5 May Danaghori 2,300 ft., 2 ♂ 21 May 1937 Kunduz 1,800 ft. (Meinertzhagen).

The House-Sparrow is a very numerous summer visitor to both Northern and Southern Afghanistan arriving in April and leaving again in August and September. It is also an abundant passage migrant. In Northern Afghanistan Meinertzhagen found them breeding in colonies mostly in holes in earth banks, sometimes in company with Bee-eaters and Rollers. On passage they pay little or no attention to houses and are very much birds of the open fields, bare mountain slopes and buckthorn hedges. In Southern Afghanistan Swinhoe remarks that they do not associate with *Passer montanus* but both he and Wardlaw-Ramsay remark that the large flocks on passage contain a good proportion of *Passer hispaniolensis*.

Meinertzhagen calls his birds *Passer domesticus bactrianus*, and as he points out, correctly enough, this name (Zarudny and Kudaschew, 1916, type locality

Tashkent, Turkestan) antidates my *parkini* (1920—Vale of Kashmir) but I can see no difference in size or colour between birds from Turkestan and South Afghanistan. As one of Swinhoe's birds from Kandahar (♂ 9 April 1881 now in British Museum) was the type of *Passer griseigularis* Sharpe, Cat. B. Brit. Mus. xii, p. 313 (1888), this name must stand for the large migratory House-Sparrow so common in Turkestan, Tibet, Afghanistan, Kashmir and other neighbouring areas which winters in parts of India.

Gymnorhis xanthocollis transfuga Hartert.

Specimen collected.—♂ 13 May 1879 Kandahar (St. John).

This is the only record of the Yellow-throated Sparrow in Afghanistan unless Hutton's account of the Rock Sparrow as arriving at Kandahar in the latter end of April and departing in autumn and being far from common really refers to this species.

Passer hispaniolensis transcaspicus Tschusi.

Specimens collected.—♂ Pashat (Griffith); sex? April 1874 Panjah (Biddulph); ♂ ♂ ♀ May 1879 Byan Khel (Wardlaw-Ramsay); 5 ♂ 5 ♀ 6-16 April 1881 Kandahar (Swinhoe); 27 October 1884 between De-Kamran and De-Doda, 1 ♂ 2 ♀ 29 November 1884 between Kar-o-bagh and Tut-i-chi (Aitcheson); sex? 10 March Kara Bel, sex? 10 March Yulla Chashma, 2 sex? 27 March Khwaja Gogirdak, 2 sex? 12 April Karawal Khana (Yate); 5 ♂ 2 ♀ 4-7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

In Northern Afghanistan Aitcheson and Yate collected Spanish Sparrows (as listed above) in March-April and October-November. These birds may well have been on passage to and from their breeding quarters farther north as in the rest of Afghanistan (where it occurs) the status of the Spanish Sparrow appears to be that of a summer visitor. In the Oxus Valley Meinertzhagen first met with it at Danaghori on 4 May and by 7 May their numbers had increased. They were equally common about Baghlan on 19 May and though breeding had not commenced it appeared likely that they were going to breed in the swamps of Danaghori. Biddulph met them in Panjah in April.

Wardlaw-Ramsay found the species common in the Hariab Valley 7,000-8,000 ft. in May and June.

At Kandahar Hutton said it was a resident, breeding both in houses and trees but this was doubtless inaccurate as St. John and Swinhoe both say that it is a summer visitor, the latter adding that it arrived in large flocks with *Passer domesticus* in the early part of April, though the testes were not then nearly so developed as in the latter bird.

Both Meinertzhagen in Afghanistan and Magrath in Kohat remark on the association of flocks of Spanish Sparrows and Rosy Pastors on migration and Ticehurst and I found that the typical race in Algeria was similarly consorting with flocks of Starlings. About buildings the Spanish Sparrow in Afghanistan assorts with both House and Tree Sparrows.

Passer moabiticus yatei Sharpe.

Specimens collected.—♂ 27 October 1884 between De Kamran and De-Doda (Aitcheson); ♀ 13 March 1903 Nad-i-ali R. Helmund (Cumming).

The above male, the type, of Yate's Sparrow, is figured by Aitcheson (Plate vi, fig. 2). The bird was said by the discoverer to be then occurring in large flocks. Cumming's female (identified by Stuart Baker) furnishes the only other information about this species actually in Afghanistan, but it is doubtless commoner in South-west Afghanistan than this implies as Zarudny and Harms (J. f. Orn. 1912 p. 592) found it a most abundant breeding bird in the tamarisk jungles of the Helmund Delta on the Persian side of the boundary. They give a long account of the bird and its breeding and one of Zarudny's eggs is figured by Dresser in *Ibis* 1903, p. 405, pl. x.

Passer montanus dilutus Richmond.

Specimens collected.—♀ May 1839 Kandahar, 2 sex? Bala Chughur Serai (Griffith); 2 ♂ 21 January, ♀ 20 April 1879 Kandahar (St. John); ♂ ♀ 18 January 1881, ♀ 2 Feb. 1881 Kandahar (Swinhoe); sex? 29 Jan. Chahar Shamba (Yate); ♂ 20 April 1905 Kuhak (Cumming); 2 ♂ 4 April Kabul 6,000 ft., 1 ♂

4 ♀ 16-18 April Ghorband 8,200 ft., ♂ 22 April 1937 Bamian 8,500 ft. (Meinertzhagen).

The Tree Sparrow is the common resident house sparrow of Afghanistan both in the North where Meinertzhagen found it all the localities he visited and in the South where both St. John and Swinhoe found it at Kandahar.

In the South-west Cumming says it was in every building in the Mission camp at Kuhak in April 1905 but he adds the somewhat surprising statement that it had disappeared in the following month.

Meinertzhagen first noted signs of breeding at Danaghori on 7 May.

Passer rutilans cinnamomeus (Gould).

Specimens collected.—5 ♂ Otipore (Griffith).

Griffith's specimens of the Cinnamon Sparrow in the British Museum provide the only records for Afghanistan.

Petronia petronia intermedia Hartert.

Specimens collected.—sex? December 1880, ♀ 13 January, ♀ 22 January, ♀ 15 February 1881, (Swinhoe); ♂ 19 April Shibar Pass 9,800 ft., 2 ♂ 1 ♀ 22 April Bamian 8,500, ♂ 28 April Doab 7,000 ft., 2 ♂ 15-16 May, 2 juv. 17 May Haibak 3,000 ft., 2 ♂ 2 ♀ 25 May 1937 Shibar Pass 9,800 ft. (Meinertzhagen).

Meinertzhagen who provides the whole of our information about this species in Northern Afghanistan first met with it singly on the flat tops of the Shibar Pass at 9,800 ft. on 19 April, when there was still much snow about. They were not uncommon in the desolate valleys, round Bamian, often associating with *Carpodacus synoica* where they were feeding on freshly sown wheat. At Doab they were met on the high tops, sometimes feeding among rocks, sometimes travelling about in small flocks. At Haibak they were breeding in holes and fissures on rock-faces, most of the young being out and about. At Kunduz they were breeding on 20 May on a rocky scarp some 10 miles west of the town. When Meinertzhagen recrossed the Shibar Pass on 25 May young were well on the wing with their parents.

At Kandahar Swinhoe considered the bird a winter visitor, not observed after the end of February. Hutton's account of the Rock Sparrow at Kandahar would seem more likely to refer in reality to the Yellow-throated Sparrow.

Montifringilla nivalis alpicola (Pallas).

Specimens collected.—♀ Afghanistan (Griffith); ♀ 23 July Kinjan Pass 11,500 ft., juv. 9 Sept. 1933 Katakhak 9,750 (Maconachie); 4 ♂ 2 ♀ 26 May Shibar Pass 9,800 ft., 2 ♂ 1 ♀ 29 May 1937 Unai Pass 12,000 ft. (Meinertzhagen).

Whitehead came upon a small flock of finches which he attributed to *M. n. adamsi*, but which in the light of subsequent information may well have been *M. n. alpicola*, on a grassy knoll of the Safed Koh at 10,000 ft. on 2nd August. They were, however, rather wild and he was unable to secure a specimen.

With this exception the Snow-Finch is only known to occur in Afghanistan in the ranges of the Hindu Kush where it breeds and is doubtless resident, with altitudinal movements.

Meinertzhagen says that a small flock were seen at the edge of a large patch of snow in the Paghman Valley 8,600 ft. in early April and again on 24 April a flock was seen near snow at about 11,600 ft. when they were very shy. But it was not until he recrossed the Shibar Pass on 25 May that he found the birds on their breeding grounds among boulder-strewn tops and steep hillsides. The females had conspicuous incubation patches. He met them again in the Unai Pass at between 12,000-12,500 ft. on 29 May. He gives a good description of the display.

Maconachie's specimen from the Kinjan Pass was collected by Captain Fletcher who found the birds in flocks of four or five amongst patches of snow.

Montifringilla theresæ Meinertzhagen.

Specimens collected.—2 ♂ 19 April Shibar Pass 9,500 ft., ♂ 22 April Bamian 8,500 ft., 2 ♂ 2 ♀ 25 May Shibar Pass 9,500 ft. (Meinertzhagen).

Meinertzhagen's Mountain-Finch, the most interesting of his discoveries in Afghanistan, was first seen on the flat top of the Shibar Pass at 9,500 ft. on 19 April, where it was often in company with *Eremophila* and *Petronia*. It was usually singly or in pairs and on more open ground (less rocky and steep) than *nivalis*. At Bamian a small party was found feeding in freshly sown wheatfields. Meinertzhagen describes the general behaviour and display of the bird. It is certain to prove a resident species.

Fringilauda nemoricola altaica (Eversman).

Specimens collected.—♀ Pushut (Griffith); 1 ♂ 4 sex? 14-24 April 1874 Panjah, Wakhan (Biddulph).

Griffith's above specimen in the British Museum is presumably the same one mentioned in his Journal as having been obtained at Loonguzee in March.

Biddulph notes that Stoliczka's Mountain-Finch was common in Wakhan in April. It doubtless also occurs further south along the eastern border of Afghanistan as it is a common but irregular winter visitor to the Samana, just over the boundary.

Emberiza pyrrhuloides Pallas.

Specimens collected.—♂ n.d. Maimanah, ♀ 1 Feb. Chahar Shamba (Yate).

These provide the only records of the Thick-billed Reed Bunting. I have not been able to examine them to identify the form more particularly.

Emberiza schoeniclus pallidior Hartert.

Specimens collected.—♀ 8 February 1881 Kandahar (Swinhoe); ♂ ♂ ♀ 20 February-3 March Chahar Shamba, ♀ 10 March Kara Bel, ♀ 10 March Gulla Chashma (Yate); ♀ 5 Nov. 1933 Bagrani 5,700 ft. (Maconachie).

These are the only records of the Reed-Bunting in Afghanistan. Swinhoe says that it is only a winter visitor at Kandahar.

Emberiza fucata arcuata Sharpe.

Specimen collected.—sex? 17 July Shadian (Scully).

In immature plumage. The only record for Afghanistan.

Emberiza leucocephala Gmelin.

Specimens collected.—♂ ♀ Pashat ♂ ♀ Kabul (Griffith); sex? 16 April 1874 Panja (Biddulph): ♂ 12 December ♀ 27 December 1879, ♂ 12 January 1880 Kandahar (St. John); 2 ♂ 2 January, ♀ 29 January 1881 Kandahar (Swinhoe); ♀ 9 December 1884 Ab-i-Kamarra (Aitcheson); ♂ 7 November Kabul 5,700 ft., ♀ 2 December 1933 Chahiltan 5,900 ft., ♀ 7 January, ♀ 30 December 1934 Logar 5,700 ft. (Maconachie).

The above records provide the only information about the Pine Bunting in Afghanistan. It is evidently a winter visitor.

Emberiza stewarti Blyth.

Specimens collected.—♂ 23 February 1840 Pashat (Griffith); 7 skins 22 April-16 May 1879 Byan Khel (Wardlaw-Ramsay); ♂ 21 July 1933 Khinjan Valley 7,700 ft. (Maconachie); 2 ♂ 8-9 April Paghman 8,000 ft., 2 ♂ 27 April Dar-e-Shikari 6,000 ft., 2 ♂ 1 ♀ 28-29 April 1937 Doab 5,000 ft. (Meinertzhagen).

Wardlaw-Ramsay found the White-capped Bunting excessively abundant in open country in the Hariab Valley 7,000-8,000 ft. about Byan Khel. It began to breed about the end of April and large numbers of their nests were found in May and June. In Northern Afghanistan Meinertzhagen found it nowhere common, but widely distributed between 5,000 ft. and 8,000 ft. They were in the snow in the Paghman Valley on 9 April and no increase or decrease in their numbers was noticed so the majority are doubtless resident though some of the winter visitors to North-west India may come from Afghanistan. Not yet recorded from the western half of Afghanistan though found in Persia.

Emberiza cia par Hartert.

Specimens collected.—♂ ♀ Pashat (Griffith); ♂ 19 April 1874 Panja (Biddulph); ♂ 19 June Speen-Gurhwar Kotal, 2 ♀ 19 June 1879 Peiwar Kotal, (Wardlaw-Ramsay); 4 ♂ 2 ♀ 4-12 April near Kabul 6,000-8,000 ft., 1 ♂ 4 ♀ 15-17 April 1937 Ghorband 6,500-8,200 ft. (Meinertzhagen).

Meinertzhagen found the Meadow-Bunting not uncommon around Kabul with deep snow on the ground in early April and in the Ghorband Valley and Bamian between 7,000 ft. and 8,500 ft. On 16 April there was a distinct increase in their numbers in Ghorband and when he passed there again at the end of May the breeding birds were limited to an odd pair at long intervals. Meinertzhagen did not meet with the species to the north or west of the Shibar Pass. It is common, however, on the south-east of this area as Wardlaw-Ramsay found it on all the lower pine-clad slopes of the Safed Koh as well as of the Peiwar Spur and over the boundary Whitehead says it nests fairly commonly on the Safed Koh up to 11,000 ft. Wardlaw-Ramsay found it breeding on 19 June at 8,000 ft. at the foot of the Peiwar Kotal.

Meinertzhagen considers the status to be that of a resident and summer visitor. It would seem likely that many of the great numbers which appear in the Western Punjab in winter must come from Afghanistan.

Emeriza buchanani Blyth.

Specimens collected.—Sex? Afghanistan (Griffith); 2 ♂ base of Kossack Pass (Griffith); ♂ 9 April, sex? 27 April 1879 Kandahar (St. John); ♂ 8 April Kandahar, ♂ 28 April 1881 Gatai (Swinhoe); ♂ ♀ 1 May 1885 Kambao (Aitcheson) ♀ 15 May near Kabul 6,200 ft., sex? 10 September 1933 Jangal Murda 12,000 ft. (Maconachie); 2 ♂ 24-26 April Bamian 8,500 ft., ♂ 29 April Doab 5,000 ft., 1 ♂ 2 ♀ 24 May 1937 Ghorband 8,300 ft. (Meinertzhagen).

Meinertzhagen found the Grey-necked Bunting to be a fairly common summer visitor to the hills of Northern Afghanistan between 5,000 ft. and 9,000 ft., first encountered at Bamian on 24 April at 8,500 ft. when 2 males in company were shot. There were more in the Ghorband Valley in mid-April but in late May they were quite common and breeding. A nest with fresh eggs was found in the Paghman Valley at 8,500 ft. on 27 May. Maconachie's specimens agree with this status but the bird at 12,000 ft. on Jangal Murda was perhaps a migrant.

Griffith is said to have found the Grey-necked Bunting in flocks near shingly or stony hills (Horsfield and Moore ii, 485). These were probably on passage as St. John and Swinhoe found it a passage migrant at Kandahar. Hutton says it is found there in summer but I do not think he distinguished very clearly between summer visitors and passage migrants. Swinhoe says it arrived in the first week of April. Numbers were found resting on the city walls on 8 April and great numbers were to be seen feeding on the road all the way to the Khojak Pass.

Emberiza hortulana Linnaeus.

Specimens collected.—7 ♂ 19-25 April 1885 Tirphul (Aitcheson).

Status uncertain. Aitcheson says that the Ortolan was very common in the vicinity of Tirphul.

Emberiza melanocephala Scopoli.

Specimen collected.—♀ 24 April 1881 Melcharea 40 m.s. of Kandahar (Swinhoe).

Evidently a straggler as St. John remarks that the swarms of Black-headed Buntings that winter in India miss Afghanistan on passage.

Emberiza bruniceps Eversmann.

Specimens collected.—4 ♂ 2 ♀ Kandahar (Griffith); ♂ May, ♀ 4 June Byan Khel, ♀ June 1879 Zabberdast Kila (Wardlaw-Ramsay); ♂ ♀ ♀ 22 April Mundi Hissar, ♀ 23 April 1881 Abdul Rahman (Swinhoe); 5 ♂ 12-19 April Tirphul, ♂ 3 May Shore Kaltegai, ♂ 4 May 1885 Gulran (Aitcheson); ♂ ♂ ♀ 28-30 April Chahar Shamba, ♀ ad. ♂ juv. 12-13 May Kila Wali (Yate); ♂ 11 June 1933 Logar Valley, ♂ 30 April 1934 Kabul 5,7000 ft. (Maconachie); ♂ 25 April Bamian 8,500 ft., 2 ♂ 27-29 April Doab 5,000 ft., ♂ 1 May

Barfak 4,000 ft., ♂ 2 May Doshi 2,750 ft., 1 ♂ 3 ♀ 5-8 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

A summer visitor to Afghanistan. In the north Meinertzhagen first met it on 25 April at Bamian, when a single cock arrived. After that date they soon became abundant, especially at Danaghori, Kunduz and Haibak. In some years it must arrive earlier as Hutton and St. John say that it arrives in Kandahar at the beginning of April and is common. Swinhoe found numbers, evidently on passage, at Mundi Hissar and Abdul Rahman feeding in the early morning and perching during the day on the mud walls of the roadside forts. It has not yet been recorded from south-west Afghanistan.

It breeds plentifully in the Hariab Valley at 7,000-8,000 ft. where Wardlaw-Ramsay found the first nest on 19 June.

Emberiza calandra Linnaeus.

Specimens collected.—4 ♂ 1 ♀ 5-8 May Danaghori 2,300 ft., ♀ 19 May 1937 Khanabad 1,800 ft. (Meinertzhagen).

The Corn Bunting has only been met with by Meinertzhagen in Afghan Turkestan at Danaghori and in the cultivated country about fifteen miles south of Khanabad. In both localities it was breeding. Meinertzhagen refers his birds to *E. c. buturlini* but specimens in fresher winter plumage which Ticehurst and I collected in Jhang district, and which must surely represent the Afghan population, could not be separated from the typical form.

(To be continued)

OCCURRENCE OF BIRDS IN MADURA DISTRICT.

BY

EDWARD G. NICHOLS.

PART III

(Continued from Vol. xliv, *No.* 4 (1944), *p.* 584).

Crocopus phoenicopterus chlorogaster. Southern Green Pigeon. *Pachai purā.*

Plains near Palni in October 1866 (Fairbank), and up to 4000′ in the Palni Hills.

Resident. Terry found them nesting in April on the hills toward Palni. Rare.

Dendrophassa pompadora affinis. Gray-fronted Green Pigeon.

Western hills, from 3000′ at Kumili up to 4000′ in the Lower Palnis. (In other districts it occurs on the plains also and up to 4500′.)

Probably resident. I have seen only 10 of this species with 6 of the Southern on June 18.

Rare; in tall trees.

Dendrophassa bicincta. Orange-breasted Green Pigeon.

The type-locality for *bicincta* is near Tellicherry.

J. R. Henderson's list of the birds of the Palni Hills includes this species without comment. (Elsewhere it has been found only in wet forests at low elevations in Travancore, Ceylon, etc.)

Ducula badia cuprea. Brown Imperial Pigeon. *Perum burā.*

From 3000′ at Kumili, to the top of the western hills. (In other districts it occurs as low as 500′ elevation.)

Resident.

Uncommon in sholas in most places, but common on the High Wavy Mts., where S. H. Prater took a specimen.

Muscadivora aenea. Green Imperial Pigeon.

A Travancore specimen is assigned to the southern race, *pusilla*.

I have seen this bird once in July at the foot of the Sirumalai. (In other districts it occurs up to about 2000′.)

Probably resident.

Rare; in thick forest.

Chalcophaps indica indica. Emerald Dove. *Pāthuhai purā.*

From the base of the hills it ranges up to 5500′ according to Terry. (In other districts as high as 7500′.)

Resident.

Uncommon; usually seen on the ground in thick jungle.

Columba livia. Rock Pigeon. *Māda purā.*

Specimens from the Nīlgiris probably belong to the southern race, *intermedia*.

Plains, and up to 6500′ in the Palni Hills. It is not easy to tell whether those near villages are wild or not.

Resident.

Uncommon; in small flocks.

Columba elphinstonii. Wood Pigeon. *Kānal purā.*

From 4000′ to the summit of the western hills. (In Travancore it ranges down to an elevation of 200′.)

Resident.

Uncommon; in sholas. Mr. F. Dawson found it common after May.

Streptopelia chinensis suratensis. Spotted Dove. *Mani purā.*

Plains, and at all elevations on the hills.

Resident in the hills. My plains records are between July 1 and April 28.

Common in the lower hills, among plantations and thin woods; uncommon on the plains and hill-tops. The *coo's* are soft, tremulous, usually 3 or 5 in a phrase, with the 2nd note higher in pitch than the rest.

Streptopelia senegalensis cambayensis. Brown Dove. *Thavittu purā.*

Plains, and Terry found them in the hills up to about 5000′.

Resident.

Common in scrub jungle and thorny waste places. The call is a rather pleasant group of notes run together: *Kaloo, kaloo, kalookl.*

Streptopelia decaocto. Ring Dove. *Sāmbal purā.*

Nīlgiri specimens belong to the typical race.

Plains, and Terry found it on the Palni Hills at perhaps 3500′. (In the Nīlgiris it has occurred as high as 7000′.)

Resident.

Fairly common, favouring thickets of euphorbia and thorn trees. The *coo's* are smooth and deep-toned, usually 3 in a phrase, with a pause before the third.

Oenopopelia tranquebarica. Red Turtle Dove. *Kalli pura.*

The type locality is Tranquebar.

Plains and base of the hills.

Resident.

Uncommon; seen by me in only 4 localities. They like thorn trees near large tanks. The call is the lowest in pitch of any of our doves. From a distance, it sounds like drumming in the next village. It may be written · *turr turtle, tub.*

Pterocles exustus ellioti. Common Sand-Grouse.

Plains. There is a local specimen in the American College, Madura. I think I have seen a few south of Vīrappāndi in the Kambam valley, and one near Batlagundu. Francis, in 1908, wrote that some were found near Āndippatti.

Resident, rare.

Pavo cristatus. Peafowl. ***Mayil.***

From 1000′ to 2000′ near the base of the western hills. (Nearly up to 7000′ in other districts.)

Resident.

Rare at the base of the Palni Hills. Reported to be common in the Varusha Nādu valley.

Gallus sonneratii. Grey Jungle Fowl. ***Kattu holi.***

Hills, from base to summit.

Resident.

Uncommon in most places, but reported by Mrs. Cantlay to be common on the High Wavy Mts. The cock's crow is of 5 syllables, preceded by a flapping of wings on his sides.

Galloperdix spadicea stewarti. Red Spur-Fowl. ***Saruhu koli.***

From 1100′ up to 7000′ on the western hills. (It occurs also below 1000′ in Travancore.)

Resident.

Less common than the Jungle Fowl in most places, but Terry found it commonly nesting at Putthūr, 6500′, in the Palni Hills. I have seen 8 in a flock. I have heard a loud *cuck-cuck-cuck-cuck, ker-whack.*

Excalfactoria chinensis. Blue-breasted Quail. *Kādai.*

A specimen taken in Chingleput District belongs to the typical race *chinensis.*

Plains, where I have one record near Dindigul on September 1, and at 1100′ in the Varusha Nādu valley on July 30. (Up to 7000′ in other districts.)

Probably resident.

Rare.

Coturnix coromandelica. Black-breasted Quail.

Plains. (Up to 7000′ in the hills in other districts.)

Winter visitor, from November 3 to February 13.

Uncommon, in grain-fields. Besides a double *tweet,* a pleasant and musical *wheat* is repeated about 5 times.

Perdicula asiatica. Jungle Bush-Quail. ***Sen kādai.***

Specimens from Salem and Coimbatore Districts are assigned to the typical *asiatica.*

Plains, and up to 1500′ on the slopes. (Up to 5000′ in other districts.) This species should be deleted from my Kodaikānal list published in 1937.

Resident.

Uncommon; in thick bushes far from habitation. I have heard a rasping, buzzing noise, like a saw going through shingle, continued for a minute or more without a break.

Cryptoplectron erythrorhynchum erythrorhynchum. Painted Quail.

3000′ to the top of the western hills. (In other districts as low as 2500′.)

Resident.

Fairly common in bushes and thick grass.

Francolinus pondicerianus. Gray Partridge. *Kavuthāri.*

The typical form has been taken at Pondicherry and on Rāmēswaram.

Plains, and by Dr. M. L. Freeman up to 7000′ at Kodaikānal.

Resident.

Fairly common; in scrub jungle and remote fields,

Turnix suscitator. Bustard Quail. *Kurun kādai.*

Specimens from Coimbatore have been placed in the subspecies *taijoor.*
Plains, and up to 3000′ at Kumili.
Resident.
Uncommon, in solitary, bushy places.

Turnix maculata. Larger Button Quail. *Mani kādai.*

Eastern Ghats specimens are assigned to the race *tanki.*

Capt. Terry took a specimen at Pallangi, 5500′, and F. Dawson caught one at 7700′ in the Palni Hills. (In adjoining districts it also occurs on the plains.)

Hypotaenidia striata gularis. Blue-breasted Rail. *Samban kōli.*

Terry obtained a specimen on April 4 at Pallangi, 5500′. (It is also found on the plains in other districts, and is a resident in Ceylon.)

Rallus eurizonoides. Banded Crake.

A specimen from Mysore is assigned to the subspecies *amuroptera.*

The only record was at 5000 on the High Wavy Mts., where a bird was caught for identification by Mr. and Mrs. Cantlay on June 16 during heavy south-west winds. (On the west coast it breeds near sea-level, but it has been taken as a stray in the hills as high as 5700′.)

Amaurornis fusca bakeri. Ruddy Crake.

Sālim Ali's specimen at Kumili appears to belong to the North Indian *bakeri,* but the resident race, *fusca,* has been taken in the Wynaad and Ceylon.

3000′ up to 6850′ in the western hills. (In Travancore and Ceylon it occurs also in the low country.)

Only 2 records, March 7 & 30.

Amaurornis phoenicura phoenicura. White-breasted Waterhen. *Nīr kōli.*

Plains, and up to 4700′ on the western hills. (In the Nilgiris up to 7000′)

Probably a resident near irrigated fields in the hills. My plains records run from November 8 to December 29 and on April 27.

Uncommon.

Gallinula chloropus. Indian Waterhen.

The type locality of the race *indicus* is Nellore.

Plains, in a few of the largest reedy tanks only. (On the Nilgiris it has been found as high as 7000′.)

Recorded from July 4 to April 27. (In Ceylon it is a resident.)

Fairly common; as many as 40 together. The call is cackling laugh lower in pitch than the Grebe's.

Gallicrex cinerea. Kora or Water-Cock.

My only record was on April 13 on a tank in the eastern part of the district.

Porphyrio poliocephalus. Purple Coot

The typical form occurs in Hyderabad State and Ceylon.
Only at three tanks on the plains.
July 5 to April 4. (A resident in Ceylon.)
Rare; in shallow water and on mud flats. One flock of 15.

Fulica atra atra. Coot. *Irāma kōli.*

On 3 of the largest tanks on the plains.
Winter visitor, from July 4 to February 20. (Resident at Coimbatore.)
Uncommon, but on September 23 I saw as many as 40 together.

Metopidius indicus. Bronze-winged Jaçana. *Thāmarai kōli.*

I have seen only a single bird, swimming on Dēvathānapatti Tank on March 23 and one on July 5.

Hydrophasianus chirurgus. Pheasant-tailed Jaçana.

On large tanks only.
From July 4 to April 13.
Fairly common on the lily-pads. I have seen up to 30 together.

Choriotis nigriceps. Great Indian Bustard.

Nelson's Gazetteer, in 1868, said: 'Bustards are occasionally met with.' The species is said to be near extinction now. It is a bird of the plains.

Sypheotides indica. Lesser Florican. *Varahu kōli.*

Plains. (In other districts it is found up to 3000′.)
Nelson in 1868 called it 'not uncommon'. R. F. Stoney shot one at Shōlavandān March 20, 1904. Francis in 1908 said floricans were occasionally seen. No recent records.

Burhinus oedicnemus indicus. Stone Curlew. *Kannādi āt kātti.*

Plains only. (Up to 3300′ in other districts.)
The American College has a local specimen. My only record is of one bird on a dry tank-bed at Madura on June 26. (Resident in Ceylon.)

Cursorius coromandelicus. Indian Courser. *At kātti.*

The type locality for the typical race ("Coromandel Coast") is probably near Madras.
In open fields near Reddiyār Chattram, 900′ elevation, I have seen a small flock several times.

Larus brunnicephalus. Brown-headed Gull. *Kadal kākai, Ponthar.*

On tanks near Madura only.
Winter visitor, from November 17 to April 1. (On Rāmēswaram Island they arrive in August.)
Rare, in flocks of about 8.

Chlidonias leucopareia. Whiskered Tern. *Kadal pul.*

A Travancore specimen is placed in the subspecies *indica.*
Sholavandān Tank only.
I have seen a flock of 40 on January 27 only. (Some stay all year in Ceylon.)

Hydroprogne caspia. Caspian Tern.

The typical form occurs in Travancore.
I have seen only a single bird at Batlagundu Tank on Mar. 29. (Some stay all year in Ceylon.)

Gelochelidon nilotica. Gull-billed Tern.

The typical form has been taken in Travancore.
I have seen two birds, which from my description were either of this species or the European Tern, at Tallākulam, Madura, on October 10. (Some stay all year in Ceylon.)

Leucopolius alexandrinus. Kentish Plover. *Uppu kotthi.*

Winter specimens from Travancore belong to the typical race.
On the plains only.
Nov. 17 to Feb. 8. (Resident in Ceylon.)
Rare; on the shores of tanks.

Charadrius dubius. Ringed Plover.

The European race, *curonicus*, has been taken in winter in Travancore. I think I have also seen the smaller resident race, *jerdoni.*

Plains, and as high as Periyār Lake, 3000′.

August 26 to March 16. (The European race occurs from early August to late April along the coast.)

Fairly common on the edge of tanks. As many as 40 together.

Pluvialis dominicus fulvus. Golden Plover.

R. F. Stoney shot one, probably near Madura, on Oct 24th. (Along the coast it is a winter visitor from August 25 to May.)

Lobivanellus indicus. Red-wattled Lapwing. *Āt kātti.*

Salem District specimens belong to the typical *indicus.*

Plains, and in the hills Terry heard its calls at Putthūr, 6500′.

I have seen the species only three times, in September near Madura. (Resident in Ceylon.)

Rare.

Lobipluvia malabarica. Yellow-wattled Lapwing.

Plains. (In other districts it occurs up to 3750′.)

Resident.

Uncommon; in dry waste land or remote fields. As many as 20 in a flock.

Himantopus himantopus himantopus. Stilt. *Pavala kotthi, Pavala kāli.*

On the shores of tanks near Dindigul and Shōlavandān.

Winter visitor, my only records being on February 21 and March 26.

(On Rāmēswaram it has been noted also in July and Nov. and it is a resident in Ceylon.)

Rare.

Tringa ochropus. Green Sandpiper. *Kal poruki.*

Plains, and up to about 3500′ in the western hills. (Elsewhere as high as 7000′.)

Winter visitor, from August 15 to May 4, the latter date being Terry's.

Fairly common, usually solitary.

Tringa stagnatilis. Marsh Sandpiper.

Plains.

Winter visitor, from October 1 to March 26. (On Rāmēswaram the species arrives in September. A few stay all year in Ceylon.)

Uncommon.

Actitis hypoleucos. Common Sandpiper.

Plains, and up to 3000′ at Periyār Lake. (Has occurred at 5000′ in Travancore.)

Winter visitor, from July 31 to April 24. (To late May in other districts.)

Fairly common.

Tringa glareola. Wood Sandpiper.

Plains, and up to 6900′ in the Palni Hills. (Up to 7000′ in the Nilgiris.)

Winter visitor, July 4 to April 26. (On the west coast a few stay all year.)

Common in wet fields and along streams and tanks.

Erolia minuta. Little Stint.

Biddulph took both subspecies, *minuta* & *ruficollis*, on Rāmēswaram.

I think I saw several near Shōlavandān on Oct. 25. (Sep. to Mar., and a few all year, on Rāmēswaram.)

Eroila temminckii. Temminck's or Brown-breasted Stint.

One bird seen near Batlagundu on Dec. 20 agrees with the description of this species. (There are Ceylon records.)

Scolopax rusticola. Woodcock. *Thadi mūk ullān.*

Specimens from the Nilgiris are called *S. r. indica.*

On the hills above 5500'. (There are a few records on the plains elsewhere.)

Winter visitor, from Oct. (R. F. Stoney) to April. (In other districts from the end of Sept. to May 25.)

Rare; along the swampy edges of sholas.

Capella nemoricola. Wood Snipe. *Kāttullān.*

At all elevations.

I have seen one among trees at Shōlavandān Tank on Mar. 28. Various observers have recorded it on the western hills. (The arrival date in other districts is Oct. 29.)

Rare.

Capella gallinago. Fantail Snipe. *Mōr ullān.*

Probably the typical race is found here.

All elevations.

Winter visitor, from September 27 (Stoney) to May 4 (Terry). (In other districts from August to June.)

Uncommon; in swamps and wet fields. R. F. Stoney shot 700 Fantails to 6409 Pintails in Madura District.

Capella stenura. Pintail Snipe. *Kīri ullān.*

All elevations.

Winter visitor, from September 10 to mid-June, according to Dr. M. L. Freeman. F. Dawson saw 5 until late May at Berijam Lake, but said they did not breed. (The arrival is as early as August 27 in other districts, and in Ceylon a few may linger all year.)

Fairly common, R. F. Stoney having kept a record of 6409 shot by him in this District.

Capella megala. Swinhoe's Snipe.

Plains near Madura.

Mr. R. F. Stoney is the only person to record the species in Madura District. His dates, according to a recent letter to me, are October 3 & November 29. (In other districts the extreme dates are September 21 to March 3.)

Rare.

Limnocryptes minima. Jack Snipe. *Sitrullān.*

All elevations. Fairbank saw a few at Kodaikānal.

Winter visitor, seen by me only on March 9 & 26 on the plains. (November 2 is the arrival date in other districts.)

Rare. R. F. Stoney found the species in smaller numbers than the Fantail.

Phalacrocorax fuscicollis. Shag Cormorant. *Nīr kākai.*

Large tanks near Madura.

I think I have seen this species on September 14 & February 14. (It is resident in Ceylon.)

Phalacrocorax niger. Little Cormorant.

Larger tanks on the Vaihai plains and toward Tirumangalam. (Up to 2000' elsewhere.)

My records extend from June 23 to April 19. Probably resident.

Fairly common; flocks of hundreds sometimes seen.

Anhinga melanogaster. Snake Bird. *Pāmbu vātthu, Neý kākai.*

On larger tanks and lakes, from the plains up to Kodaikānal, 6850′.

My records extend from July 4 to April 6.

Uncommon, but as many as 30 may be seen together. Common on Periyar Lake; occasional at Kodaikānal.

Threskiornis melanocephala. White Ibis. *Vellai arivān mūkan, Kuruhu.*

I saw one near Sholavandān on Aug. 10. (Resident in Ceylon.)

Plegadis falcinellus. Glossy Ibis. *Karuppu arivān mūkan.*

I have only 2 records, in Dec. & Jan., at the big tank near Shōlavandān, both in breeding plumage. (Resident in Ceylon.)

Xenorhynchus asiaticus. Black-necked Stork. *Periya nārai.*

The typical race is probably found here.

I have seen only one, at Palni on June 25. (Probably resident in Ceylon.)

Anastomus oscitans. Openbill Stork. *Natthai kutthi nārai.*

Near the tanks of the lower Vaihai plains and toward Tirumangalam.

My records extend from June 28 to April 19.

Fairly common. I have seen as many as 400 in a day, but for months at a stretch none at all.

Ardea purpurea. Purple Heron. *Sen nārai.*

Probably the race *manillensis* is found here.

At the large tanks on the Vaihai plains.

Winter visitor, from July 4 to Apr. 4. (Resident in Ceylon.)

Uncommon.

Ardea cinerea rectirostris. Gray Heron. *Sāmba nārai, Naraiyān.*

At the larger tanks on the plains.

Probably resident, but I have no May records.

Fairly common when there is plenty of water. I have seen as many as 50 in a locality.

Egretta alba. Large Egret. *Ven nārai.*

A Travancore specimen belongs to the race *modesta.*

At the larger tanks on the plains.

Winter visitor, from June 28 to April 19. (Resident in Ceylon.)

Fairly common, as many as 100 together.

Egretta intermedia. Smaller Egret.

Travancore specimens belong to the typical race.

In watery places on the plains. (Up to 2000′ in other districts.)

Winter visitor, July 26 to April 19. (Resident in Ceylon.)

Fairly common, but not met as often as the preceding.

Egretta garzetta. Little Egret. *Vellai koku.*

The typical race has been obtained in N. Kanara.

In the wettest parts of the District, on the plains. (Occasionally found in the hills in Ceylon.)

I have no records in May, but presume they stay all year if there is a tank with any water left in it.

Common. I have counted as many as 260 in a flock on Apr. 19. Plumes on lower back noted on Nov. 6. The call is a deep, long-drawn *kwawr.*

Bubulcus ibis coromandus. Cattle Egret. *Unni koku.*

On the plains, in wet but not necessarily very wet places. (Found also in the lower hills in Ceylon.)

Winter visitor, Oct. 10 to Apr. 19. (Resident in Tinnevelly Dist.)

Fairly common, often in flocks of about 50.

Ardeola grayii. Pond Heron. *Kuruttu koku, Pottai koku.*

Plains, and up to Periyār Lake, 3000′. (In the Nīlgiris the species wanders up to 7000′ in winter.)

I have no May records, but a few probably stay all year. The bright plumage of the breeding season is evident from April to July.

Abundant wherever there is water in fields or tanks. The call is a soft croaking *kawk.*

Butorides striatus. Green Heron. *Thōshi koku.*

Travancore specimens belong to the race *javanicus.*

Plains. (In other districts it occurs up to about 3000′.)

Winter visitor, July 4 to Apr. 19.

Rare, in trees near water. I have heard it give a shrill, hen-like squawk.

Nycticorax nycticorax. Night Heron. *Vakā.*

Specimens of the typical race have been taken in Mysore.

Plains. (In other districts it occurs up to about 3000′.)

Winter visitor, July 4 to Mar. 28. (Resident in Tinnevelly Dist.)

Uncommon in most places, but I am told that they gather in large numbers to roost in trees at a village along the Vaihai above Madura.

Ixobrychus sinensis sinensis. Yellow Bittern. *Manal koku.*

Sālim Ali procured a specimen at Periyār Lake, 3000′, on Mar. 7. (It is also found at sea-level on both coasts.)

Dupetor flavicollis. Black Bittern. *Karun koku.*

A Travancore specimen is assigned to the typical race.

Plains, and Fairbank saw one at about 4500′ on the Palni Hills. (Elsewhere it has occurred as high as 7000′.)

My only record was on Dec. 5. (Resident in Ceylon.)

Rare.

Botaurus stellaris stellaris. European Bittern. *Koku.*

Plains near Madura.

Winter visitor; has been shot twice, on Feb. 25 by R. F. Stoney, and in Feb. or March by Dr. C. B. Harrison.

Rare.

Nettapus coromandelianus coromandelianus. Cotton Teal. *Thāmarai chirahi, Kulla vātthu.*

On the larger tanks on the plains.

Winter visitor, July 1 to Apr. 13. (Until the end of Apr. in Tuticorin. Resident in Ceylon.)

Fairly common.

Dendrocygna javanica. Lesser Whistling Teal. *Kīchu chirahi.*

Plains, on the larger tanks. (Up to 2500′ in Mysore.)

Winter visitor, Oct. 29 to Apr. 13. (Resident in Ceylon.)

Uncommon.

Anas poecilorhyncha. Spotbill Duck. *Sen gāl vātthu.*

The typical race was first described from Ceylon.

On the plains, I have seen only one bird near Batlagundu on Dec. 2. Several friends report that it breeds at Kodaikānal and Berijam Lakes, 7000′.

Resident, probably.

Rare.

Anas strepera. Gadwall.

I saw a few on Oct. 7 at a tank near Shōlavandān.

Anas crecca. Common Teal. *Kannādi chirahi.*

Probably the typical race occurs here. Taken in Mysore.

Plains.

Winter visitor, from Oct. 8 to Apr. 13. (In Tinnevelly Dist. until May 15.)

Uncommon.

Dafila acuta. Pintail Duck.

Plains.

Winter visitor, from Oct. 29 to Feb. 20. (Departs in Mar. at Tūticorin.)

Fairly common. I have seen as many as 320 in a flock.

Querquedula querquedula. Garganey Teal. *Vālān jirahi.*

Plains.

Winter visitor, from Dec. 21 to Apr. 24. (Sep. 24 to June in other districts.)

Fairly common. I have seen up to 1000 on a tank.

Spatula clypeata. Shoveller. *Āndi vātthu.*

Plains. (In other districts it occurs up to about 3000′.)

Winter visitor, from Sep. 23 to Feb. 20. (Has nested in Ceylon.)

Uncommon; on fair-sized tanks.

Aythya fuligula. Tufted Duck.

The typical race has been taken near Bombay.

I have seen one bird probably of this species near Shōlavandān on Jan. 14. Also one at Ganguvārpatti Apr. 26 to May 1. (Arrives Nov. 12 in Salem Dist.)

Podiceps ruficollis capensis. Grebe. *Mukulippān.*

Plains, and Fairbank found a nest at Kodaikānal, 6850′. I do not think it occurs in the hills now.

I have no record in May, but presume that a few stay all year if any water remains in the tanks.

Common. I have seen as many as 180 together. They give a shrill, whistling laugh, and a sharp little *crick* call.

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ADDENDA.

Since the publication of my list of passerine birds in the April 1944 issue of the *Journal*, I have deleted two doubtful names from the latter half of the list, so the total Madura District list is reduced to 229. The following eight species have been recently added to that total, making 337.

Anthus trivialis. European Tree Pipit. *Pul kuruvi.*

The typical form has been obtained on the Nilgiris.

6200′ to 7000 at Kodaikanal. (As low as 2500′ in Mysore.)

Winter visitor, well seen on Oct. 30, and from Feb. 22 to Apr. 20, the last by E. L. Bradby.

Less common than the Indian Tree Pipit, with which it sometimes associates. There seems to be some doubt whether this species has previously been found south of the Nilgiris.

Dinopium javanense. Three-toed Woodpecker. *Thachan kuruvi.*

The race *malabaricum* has been taken in Travancore.

S. K. Bunker had a good view of two at about 3700′ in the Palni Hills. (Resident from 200′ to 5000 in western districts.)

Cacomantis merulinus. Plaintive Cuckoo. *Kuyil.*

Specimens of the subspecies *passerinus* have been taken in Travancore.

Plains only. (Also as high as 8000 in other districts.)

Migrant. My only records are in Nov. and March. (Resident in the Nilgiris.) Rare; in dense trees, in open country.

Astur trivirgatus. Crested Goshawk. *Vallūru*

The typical *trivirgatus* has been taken in Travancore.

There are a few sight records, from Jan. 28 to July 6, in sholas near Kodaikanal. The lowest elevation was 5400′ by S. K. Bunker, the highest 7000. (In Ceylon it occurs also in the low-country forests.) Probably a rare resident.

Rostratula benghalensis. Painted Snipe.

Madras specimens belong to the typical *benghalensis.*

Plains; probably resident.

Mr. J. Beckett has shot 4 birds, and says the species is not rare near Madura. Mr. E. O. King saw one on a nest near Madura in August. I have a doubtful record at Virappāndi in Feb.

Phalacrocorax carbo. Large Cormorant. *Nīr kākai.*

The subspecies found in India is *sinensis*, according to Stuart Baker.

Plains. My only record is at Shōlavandan Tank on July 4, one bird (Resident in Chingleput Dist.)

Ixobrychus cinnamomeus. Chestnut Bittern. *Sen koku.*

A pair was seen in screw-pines along the Suruli River at Vīrappāndi on Sep. 6. (Resident in Ceylon. Occurs up to 4000′ in the Nilgiris.)

Netta rufina. Red-crested Pochard.

I have only one record of 3 at Batlagundu Tank on Apr. 10, 1944. Rare winter visitor to the plains.

A SKETCH OF THE BOTANY AND GEOGRAPHY OF NORTH BURMA

BY

F. KINGDON-WARD, B.A., F.R.G.S., F.L.S., ETC.

(*Continued from Vol.* 45 (1944), p. 30).

PART III

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XI. MIXED TEMPERATE FOREST.

This is essentially an all-forest transition zone between Broad-leafed Forest and Silver Fir Forest. It includes a mixture of broad-leafed trees, evergreen and deciduous, together with several conifers, but especially *Tsuga dumosa.* It is *par excellence* the zone of oaks, magnolias, tree rhododendrons, epiphytic rhododendrons, maples, cherries and ilex. It is also the first zone in which laurels cease to count, although there are still a few left. Nevertheless it is not a well-marked type of forest, having many species in common with the zones above and below it. Its tree rhododendrons help to distinguish it from the cool Temperate Rain Forest below, its mixed conifers distinguish it from the Silver Fir Forest above; although the uppermost belt of the Mixed Temperate Forest is sometimes almost pure hemlock (*Tsuga*).

Two fairly constant datum lines are furnished by (1) altitude above which frosts are prevalent in winter and (2) the altitude above which, on the average, snow lies for an appreciable time. The former may be taken as about 7,000 feet, and it fixes the lower limit of the Mixed Temperate Forest. The latter is about 9,000 feet, and it fixes the upper limit. Sometimes as in the Hpimaw hills, Subtropical Pine Forest passes above into Mixed Temperate Forest, sometimes Temperate Pine Forest does the same, as in the Adung valley. In the former, Mixed Temperate forest begins below, in the latter above 7,000 feet. The Conifers of the Mixed Temperate Forest, with the exception of *Larix Griffithiana*, do not ascend above 10,000 feet. They include *Taiwania cryptomerioides, Tsuga dumosa* and *Picea brachytyla.* In the Adung valley very fine specimens of *Larix. Tsuga* and *Picea* occur at 8,000 feet mixed with smaller, but still large birch and maple (*Acer tetramerum, A. flabellatum*) and groves of *Rhododendron magnificum.* A little higher gnarled trees of *R.*

arizelum are met with, often in pure stands. The forest here is diverse, with small trees and shrubs in great variety, not only rhododendrons, but also species of *Euonymus, Berberis, Enkianthus, Clethra, Lyonia, Acer, Ribes, Sorbus, Photinia, Hydrangea, Sarcococca* and many more; and although there are no alpines, there are many early summer flowering woodland herbaceous plants, including colonies of *Iris Wattii*, species of *Arisaema, Polygonatum, Primula* (two or three species), several orchids, *Ophiopogon, Viola, Souliea vaginata, Androsace Henryi.* But it is the great variety of deciduous trees which is remarkable, they are more numerous here, just before the broad-leafed forest finally passes over into pure Coniferous Forest, than anywhere else. The mixed forest too has a familiar northern appearance and is astonishingly beautiful in May, when the trees are in young leaf of many colours, the rhododendrons in bloom and the green carpet of woodland herbs is spread. Among deciduous trees are *Tetracentron sinense*, a large tree common along the rocky banks of the Adung river, *Fraximus, Zanthoxylum, Prunus brachypoda, P. Kingdonwardii*, and the beautiful carmine cherry, *P. cerasoides, Magnolia rostrata, M. mollicomata, Acer Wardii.* Eight or ten species of oak occur (*Lithocarpus* and *Quercus*), some evergreen. Perhaps the most easily recognised are *Lithocarpus pleiocarpa* and *Quercus lamellosa*, the latter ascending in stunted form along the crests of the ridges to over 8,000 feet, mixed with *Rhododendron Martinianum.* Another common oak is *L. xylocarpa.* Most of the oaks however have a range of 3,000 feet or more and extend well down into the cool temperate zones or Temperate Pine Forest. Nevertheless associated with Ilex (of which characteristic species are *I. melanotricha, I. dipyrina, I. yunnanensis, I. burmanica*) *Magnoliaceae, Tsuga dumosa* and other trees, they form a type of forest which is easily recognised.

Mention must be made of a big tree, *Zanthoxylum*, which grows on Imaw Bum above the Ngawchang valley, unnamed because found flowerless and leafless (future explorers should look out for this) and of *Viburnum Wardii, Berberis hypokerina, Gamblea ciliata, Acer Wardii* and *Sorbus Harroviana*, all characteristic of Mixed Temperate Forest.

But the most interesting and unexpected discovery in the Mixed Temperate Forest was *Cornus suaedica*, which I found at about 9,000 feet altitude in July 1937 above the Nam Tamai, the first purely Arctic plant, other than one or two grasses, recorded from Sino-Himalaya. Another interesting find in the same place was *Stylophorum*—a plant hitherto known only from the Eastern Himalayas.

The great Rhododendron Belt which is 5,000 feet deep, extending between 7,000 and 12,000 feet throughout North Burma is already well developed by the time we enter this zone; it reaches its zenith in the Silver Fir Forest. One of the most characteristic species of the mixed temperate zone is the un-Rhododendron like small tree *R. Genestierianum* with bunches of tiny plum-purple flowers and willow-like leaves, snowy white beneath. There are also the epiphytic yellow-flowered shrubs, *R. butyricum* and *R. seinghkuense.* The Sikkim *R. triflorum* occurs in the Adung valley, and *R. megacalyx* has its *locus classicus* near Hpimaw. Between February and June this Rhododendron Belt is extraordinary rich in bird life, many of them directly cross-pollinating the flowers. Every Spring a great wave of bird life passes up the Adung valley. Many no doubt are summer residents; but the valley may also well be one of the main migration routes to the north. It may be remarked that snakes are peculiarly abundant between 6,000 and 8,000 feet in the Adung valley and appear to take heavy toll of eggs, and of young birds, many of which build their nests close to the ground.

The climate has been sufficiently indicated. Above 7,000 feet frosts, at least in the open, are usual in winter; above 9,000 feet snow lies under the trees for some weeks. Spring and Autumn are well-marked seasons, Summer and Winter hardly less so.

Endemics in the Mixed Temperate Forest are: *Berberis hypoherina, Prunus Kingdonwardii, Ilex melanotricha, I. burmanica, Sorbus paucijuga, S. verticillata, Rhododendron butyricum, R. seinghkuense, R. vesiculiferum, Eurya Wardii, Photinia rufa, Acer taronense.* Although *Taiwania cryptomerioides* is by no means endemic, its occurrence along the Burma-Yunnan frontier is one of the most interesting facts in the geographical distribution of plants, a clear example of discontinuity across 2,000 miles of apparently suitable country between Formosa and Yunnan. We may infer that it is a geologically ancient species—a living fossil—and that its ancient distribution was far wider than it is today.

Its existence along this north-west-south-east line also points to an important line of migration during glacial times.

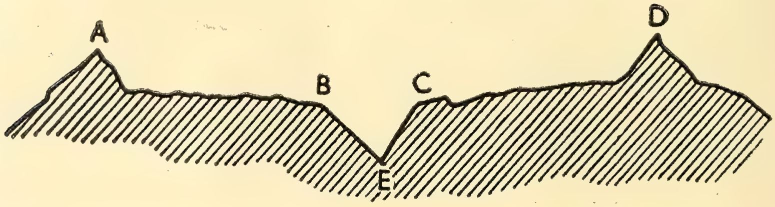
XI (*a*). Bamboo Forest.

Bamboos are an important constituent of the undergrowth of every type of forest seen in North Burma with the exception of Subtropical Pine Forest. In the lowest hill cultivation (500-2,500 feet) at least, the place of the destroyed forest is usually taken by bamboo (e.g. *Dendrocalamus Hamiltonii* along the 'Nmai Hka valley on the road to Htawgaw, and on the Putao road). Whether this bamboo forest is permanent or not it is impossible to say. *Dendrocalamus Hamiltonii* flowers at irregular intervals, but it appears to die after flowering, and it is possible that the forest would come back if left to itself. Again at 7,000-8,000 feet, fire appears to encourage invasion by bamboo, as in the Chawngmaw valley below Imaw Bum.

Many species and genera of bamboo are included in the various zones. Most of them—above 5,000 feet probably all of them, are gregarious, notably species of *Arundinaria.* Very little is known about these. In the valley of the Nam Tamai, at 3,000-4,000 feet, several large tufted species occur; but the majority grow from long horizontal rhizomes, and are gregarious. The so-called 'cane brake' frequently met with in the alpine regions is a dwarf very hardy bamboo of what genus I do not know, probably *Phyllostachys.* Although permanent seres of bamboo jungle are frequent at low altitudes, and great areas of forest with gregarious bamboo as the principal undergrowth commonly occur (e.g. on the flanks of Imaw Bum), I have restricted the term Bamboo Forest to a special formation met with in certain places at 9,000 feet more or less. Here a moderate sized bamboo growing in ill defined clumps in close proximity to one another, interrupted by scattered trees, is the chief constituent of the forests.

Of its status I know little, but it appears to be confined to the zone I have called Mixed Temperate Forest (7,000-9,000 ft.) between the zone of *Pinus excelsa* (where that occurs) and *Abies*, and is associated with another local development of that zone to which I have applied the name Moss Forest.

Bamboo Forest, as here defined, is probably local, but it is not uncommon. I have several times marched through it along a switch back ridge which maintains the same average altitude for two or three miles, where the spur seems to mark the floor of the old glacier valley before the rivers began to cut out their deep V-shaped notches. This ancient valley floor is found at about 9,000 feet, and is indicated by the comparatively level spur between two much steeper pitches, as seen in the figure below. Thus, ascending to the crest of a main range *via* a spur, there is first a steep climb out of the new valley into the old valley, then a much more gentle ascent along the spur, for two or more miles, to the base of the range, and finally a steep climb up the flank of the range to the crest. This is shown in the diagram, which represents a section from east to west across the Nam Tamai valley lat. 27° 30′ (not drawn to scale).



AD = old (ice) valley BC = new (water) valley EC. EB. = steep slopes.

The Nam Tamai flows at about 4,000 feet. The climb out of the valley to the ice shelf or floor of the old valley is 4,000-5,000 feet. From there to the foot of the range is a gradual rise of 1,000-,2,000 feet finishing with another steep climb of 3,000-4,000 feet to the summit of the range. How far down the flanks of the spur this bamboo forest prevails I am unable to say for certain, but I have found little change 500 feet below the crest, the breadth of which does not usually exceed a dozen yards, though it is apt to widen out unexpectedly in places.

It is remarkably easy to get along these ridges, and there are plenty of possible camping sites, with here and there a water hole. The outstanding characteristics of this Bamboo Forest are, firstly, the occurrence of clump forming types of bamboo, unusual at this altitude. Secondly the few trees met with, always widely spaced; thirdly the almost complete absence of any other undergrowth except small fragile herbaceous plants which come up during the rains, such as *Anemone*, several orchids, *Cruciferae*, *Caryophyllaceae*, *Ranunculus*. It is astonishing to see so much good soil unoccupied. It can hardly be due to shade—vegetation flourishes in just as little light elsewhere. Many bamboos even in the dry weather contain free water in their joints—quite potable. From November on, it is not unusual for the haulms to split longitudinally, with a sharp crack, and I have on occasions seen a pint of water shot out. It may be that on dry ridges this is an appreciable source of water for the forest. What species, if any, regularly contain water, is a matter for investigation.

XI (*b*). Moss Forest.

What may be called Moss Forest, where all the tree trunks are heavily padded and swathed with moss, in which grow epiphytic species of *Vaccinium, Rhododendron, Gaultheria, Aeschynanthus,* also a tiny *Utricularia* is a special development of the Mixed Temperate Forest. It comprises a number of broad-leafed trees mostly deciduous, several species of tree rhododendron, and very few conifers. The undergrowth consists of bamboo with the gregarious fern, *Lomaria* and scattered herbaceous plants such as *Arisaema, Elatostema.* Many of the trees have large leaves, e.g. *Magnolia rostrata* and *M. Campbellii, Rhododendron sino-grande*, species of *Acer*; on the other hand *Ilex intricata* with tiny leaves and *Betula* are equally characteristic. Shrubs include *Eurya.* Tremendous granite cliffs largely bare, often outcrop in this zone, shrubs found growing in cliff crevices are *Symplocos, Berberis, Edgeworthia Gardneri, Viburnum, Cotoneaster* and *Rhododendron.* Alpines hardly exist, though a dainty white flowered *Allium* is not rare. The Moss Forest is open and not difficult to penetrate, if one keeps out of the gullies, though one's way is often barred by unexpected cliffs. The altitude is too-high for *Pinus excelsa*, not quite high enough for silver fir, not quite right for hemlock.

XII. Silver Fir Forest.

Even before we reach the Silver Fir Forest we are within the zone which enjoys a hard winter with heavy snowfall, the snow lying for a month or more, at least in the neighbourhood of high mountains, e.g. the Adung valley at 9,000 feet. For the next 3,000 feet there is little change in the outward appearance of the forest which is dominated by Silver Fir (*Abies Fargesii*). Looking across an alpine valley at the steep slope opposite, one sees nothing but a solid phalanx of fir, tier above tier reaching up to the clouds or to the snow, with here and there a solitary larch. One would scarcely suspect that there were any broad-leafed trees, so solid does the fir forest appear,—viewed, that is, from the outside. Seen from within it is rather different; and it is probable that there is almost as much rhododendron as fir—though the rhododendrons are not all of one species. Occasionally when the mountain side is unusually precipitous and rocky, the rhododendrons come to the surface so to speak, and in Spring provide an indescribable blaze of colour where countless thousands of trees and bushes are lit up with pink, purple, scarlet, yellow and white blossom. But more often the rhododendrons are hidden, or an occasional bush is visible. There are deciduous trees, maples and birch, even magnolias also scattered about, mostly below 10,000 feet; they are generally shorter than the firs. No zone is more easily recognised than this one. Silver Fir either grows by itself forming practically pure fir forest, or not at all. It brooks no rival, conifer or broad-leafed tree. Between 8,000 and 9,000 feet, one may find half a dozen big conifers, vieing with each other; but when Silver Fir appears, everything else makes way and it has the field to itself—except of course for rhododendrons, and as already said a few smaller and more scattered broad-leafed trees.

Rhododendrons include *R. sino-grande, R. sidereum* and *R. arizelum*, all common in the Hpimaw hills. In the Adung valley, there are also *R. niphargum* and *R. Beesianum*. The highest of all tree rhododendrons, *R. praestans*—belongs rather to the next higher zone, although it does not occur apart from *Abies*.

The first sub-alpine rhododendron met with is the small bush-like, rock-loving *R. Beanianum* with gorgeous waxy blood red flowers, which occurs at the lower limit of fir forest in the Seinghku valley. The Sikkim *R. fulgens* I found in the Nam Tamai valley in 1937.

In these big alpine valleys there is plenty of ground on which trees will not grow—boulder beds, cliffs, bogs, and the like. The higher we climb, the more the fir forest is broken up into isolated wedges separated by screes and alluvial fans[1], which owing to the mechanical effects of avalanches, are always devoid of trees. Above 10,000-11,000 feet, these fans, which are more fully described later, are the abode of a specialised alpine vegetation.

Fir Forest under the conditions prevailing is open, and many shrubs as well as alpine flowers and thickets of *Arundinaria* grow amongst the trees. Here are found species of *Cotoneaster, Berberis, Ribes, Lonicera, Salix, Spiraea,* as well as *Rhododendron. Corylus ferox* and *Sorbus Wardii* are characteristic small trees of the lower zone. *Myricaria* grows thickly with *Arundinaria* along the banks of streams, and in autumn many of the shrubs such as *Berberis, Lonicera, Cotoneaster, Sorbus* are covered with blue, scarlet or white berries making a fine display. Patches of meadow begin to appear both in the valley where the ground is boggy, or on ridges and slopes. In the cold Chawngmaw valley on the north-west flank of Imaw Bum, firs descend below 9,000 feet and there are extensive patches of open meadow above the torrent, where alpine herbaceous plants grow, notably *Lilium giganteum, Meconopsis paniculata, Notholirion campanulatum, Allium, Lactuca, Solidago, Ligularia* and twining *Aconitum*. Here the clash between meadow and forest is at least in part due to human interference, for the forest is periodically set fire to (without felling) in winter by the hunting tribes. Bamboo struggles with meadow for possession of the vacant ground, especially along the crests of the spurs, where forest has either been burnt or will not grow. *Nomocharis pardanthina* is abundant here. In a patch of boggy meadow I found a colony of *Meconopsis* growing with *Omphalogramma.*

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[1] Strictly speaking a scree is a cone of fragments split off from the cliff above, building itself up without any other assistance, while an alluvial fan is detritus washed down from a gully in the cliffs. In the snow bound alps of North Burma this distinction is largely lost.

There are few climbing plants in the Fir Forest, *Clematis Spooneri* not ascending above 10,000 feet; and few epiphytes except moss, one or two small ferns, and a minute Utricularia (*U. orbiculata*). A large edible red coloured fungus is common on *Abies* in the Adung valley. Apart from *Pinus*, the only other conifer to form pure stands in North Burma is hemlock (*Tsuga dumosa*), which occurs at the base of the Fir Forest sometimes forming a well-defined belt. Otherwise it forms a link between the mixed conifers of the Upper Temperate Forest and the Silver Fir Forest.

Above 10,000 feet numerous primulas occur amongst the many scattered shrubs. One of the first to appear is *P. sikkimensis*. But primulas are never so profuse in this damp climate as they are further east in China or further north in Tibet. The dainty little *P. eucyclia* which grows on wet cliffs at 9,000 feet is endemic. With it is sometimes found *Asteropyrum peltatum*, a curious little plant of the family *Ranunculaceae*. *P. Agleniana* (the pink flowered var. *thearosa*), which is known only from the Seinghku valley, grows in rocky gullies, and from the same place is recorded the first known example of *P. calthifolia*, a rare plant here, but common in the Mishmi hills of the Assam frontier. Another endemic is *Rhododendron myrtilloides*, found at one spot in the Chawngmaw valley, at under 9,000 feet, which is remarkably low down for a dwarf rhododendron of the *Campylogynum* type. It probably occurs higher up. There is also *R. imperator*, another dwarf from 10,000 feet, found once only in the Seinghku valley.

So we can picture the high rocky alps of North Burma as a dynamic landscape, rent by deep, steep gorges through which torrents tumble and roar over boulders, under snow beds, while waterfalls and avalanches crash over the cliffs, and down the glens. The top forests consists of silver fir and rhododendron, frequently interrupted by steep alluvial fans, chequered with alpine meadow, surrounded by precipices. In early summer, when all the mountain-scuppers are foaming with the snow melt, the dark and sombre forest is illuminated by the flowers of millions of rhododendrons, many of which are found also in the loftier mountains of western China or in the Assam Himalayas, or in Tibet. Comparatively few of the Sikkim rhododendrons are found in North Burma, though several are represented by allied species. The same is true of primulas; *P. sikkimensis* and *P. Wattii*, the last rare, are the only Sikkim species known so far. Alpine shrubs include besides many species of rhododendron, *Lonicera myrtillus* and *L. cyanocarpa*, *Ilex intricata* and *I. Georgei*, *Sorbus filipes* and *S. Rehderiana*, *Prunus mugus* and *Magnolia globosa*, all growing within the limits of Fir Forest below 12,000 feet.

In the meadows, alpine herbaceous plants—*Primulus*, *Iris*, *Nomacharis*, *Cremanthodium*, *Swertia*, occur in great numbers rather than in variety. That is equally true of the dwarf rhododendrons in the more strictly alpine region. No one who has seen the drifts of sunny yellow *Primula melanodanta* or purple heath of "Lapponicum" rhododendron can ever forget it. Yet it does not compare with similar colour displays in eastern Tibet.

At 12,000 feet, and often far below, the valleys are snow bound till May or June, although the cliffs stand out naked, and south facing slopes may be clear of snow. There is no definite Spring; Spring and Summer are one. True, some rhododendrons flower in April or May, in the snow, but it must be remembered that their flower buds were completed the previous year. They need only water and sunshine to stretch them. Some gentians likewise flower in October or November, when the berries on the leafless honeysuckles are ripe, and the leaves of the barberries have turned scarlet, and those of the larch, champagne yellow. But the bulk of the vegetation is at rest, outwardly at least, half the year. Summer temperatures are moderate. It can be very hot *in the sun*, for a short time at 10,000 or even at 12,000 feet in July, but the average summer temperature above 10,000 feet is no more than cool temperate. June is cool or even cold, by reason of the great amount of snow melting, and this be it remembered, in a lower latitude than Cairo or Florida.

Undoubtedly the most prominent characteristics of this zone are variety of scene and movement—violent movement, falling rocks, crashing rivers, rushing avalanches, with wind, and rain and snow—and occasionally sunshine.

Endemics are: *Primula eucyclia, P. siphonantha, Gaultheria minuta, Sorbus Wardii, Rhododendron imperator, R. Beanianum, R. pruniflorum, R. myrtilloides, Leptodermis Wardii, Berberis burmanica.*

XIII. RHODODENDRON SCRUB (SUB-ALPINE SCRUB).

This is a transition zone between forest and alp, characterised by a great variety of rhododendrons, from big trees to dwarf undershrubs. Rhododendron scrub and alpine herbaceous might also be regarded as two aspects of the same climax formation—the one confined to sheltered, the other to exposed slopes. But if we take that view, which is the climax formation? The tree-rhododendrons and large bushes together with *Acer caudatum* and species of *Sorbus*, which are conspicuous at 11,000-12,000 feet, can hardly be regarded as alpines, although a great many herbaceous alpines and undershrubs like *Cassiope* also grow here. The only alternatives to recognition of a scrub climax are to include the 11,000-12,000 feet belt in the forest zone, or to extend the alpine belt below 12,000 feet so as to embrace it. Neither is satisfactory. Therefore the simplest solution seems to me to be to recognise the existence of a distinct climax formation between the two, dominated by *Rhododendron*—one which I have often recognised in the field (Seinghku, Adung and Gamlang valleys). So far as *Rhododendron* at least is concerned it is a climax formation; more species grow here than in any other zone of equal depth. Both above and below this zone they begin to fall off, although still plentiful. Within the limits of the Silver Fir Forest, several tree-rhododendrons make their appearance. *R. sino-grande* stops below 10,000 feet, *R. arizelum* below 11,000 feet, its place taken by *R. Beesianum*, often mixed with *R. niphargum* though the last named occurs lower down also. Then *R. praestans* appears at over 12,000 feet in the Adung valley, the highest of all tree species. But from 11,000 feet to well over 12,000 feet, *R. selense*, a small tree or large bushy shrub, growing gregariously, dominates the scene.

It lines the river banks, forms impenetrable thickets on steep slopes, invades the fir forest. In full bloom, with flowers of many shades of pink and cream, it is a gorgeous sight. At about the same altitude, where the fir forest is becoming disjointed, another bush species, *R. cerasinum* is commonly seen. But it is the dwarf rhododendrons growing in boggy ground, or rocky slopes exposed to the sun and warm up-valley wind which attract our attention. In North Burma there are at least a dozen species of dwarf rhododendron, half of which are characteristic of this belt, and nearly all of which are gregarious, growing very like heather in Scotland, but with flowers of many colours. They belong to different sections of this large genus, known as 'Lapponicum', 'Anthopogon', 'Saluenense' and others, with several species of each section.

Generally speaking, at these altitudes it is wind rather than cold, which is hostile to tree growth, and lack of water rather than wind which is hostile to scrub growth. For this reason forest survives further up the flanks of the big alpine valleys than along the bottom. It fades out in narrowing bands divided by belts of scrub. Still further up the valley similar belts of scrub alternate with screes to stripe the sheltered slope, while the more exposed slope is all scree and barren cliffs. The normal tree line may be taken as 12,000 feet though isolated stands of silver fir and an occasional larch are found higher. Thus at 12,000 feet forest, scrub, and alpine herbaceous abruptly dovetail into one another. A very slight change of aspect is enough to alter the vegetation type.

The scrub does not always consist entirely or even mainly of rhododendron. Sometimes a pure stand of *Betula utilis*, the stunted close-growing trees not more than 10-12 feet tall is found. Elsewhere a mixed scrub of *Rhododendron, Juniperus, Berberis, Spiraea, Rosa sericea* with small bushes of *Sorbus* and *Prunus* adds variety to the scene. Lining the bank of the river, such as the Adung between 11,000 and 12,000 feet, will be *Myricaria esculenta* and *Arundinaria* as well as *Rhododendron.*

A feature of the scrub above 11,000 feet, when growing on steep slope, is the way the trunk at first grows out horizontally or even inclined downwards parallel to the slope before becoming upright. This is a mechanical effect produced by pressure on the young plant, which is laid flat each year by the weight of snow, until strong enough to resist. This is well seen in *Betula utilis* and in several species of *Rhododendron,* not however 'dwarf' rhododendrons. The latter are always either prostrate like *R. repens,* or erect, bushy under-shrubs. It is almost impossible to get through such scrub without hacking one's way foot by foot. Another impenetrable form of scrub is furnished by a small species of *Arundinaria* with solid stems, which ascends above the tree line, occurring in gullies and on ridges and slopes too austere for Silver Fir.

Between 11,000-12,000 feet, which I have called the Rhododendron Scrub Belt after its dominant feature, are found not only more than 20 species of *Rhododendron,* but a large number of herbaceous alpines also; in fact with few exceptions the entire alpine herbaceous flora. They grow scattered or in colonies, larger and smaller, in patches of meadow along the banks of streams, on sandy river flats, on alluvial fans and screes, in marshes, on cliffs or amongst trees, scrub, and dwarf rhododendron heath; while every large boulder which has come to rest in the valley, brought hither by some long vanished glacier, forms a home for them. Primulas abound, sometimes in colonies like *P. melanodonta* and *P. sikkimensis* or scattered like *P. Genestieriana* and *P. muscarioides.* Other colony forming plants are *Cypripedium tibeticum, Nomocharis Souliei, Omphalogramma Souliei, Caltha palustris.* Many species form compact clumps, which are really small close colonies. *Iris kumaonensis, Polygonum Griffithii, Sedum, Saxifraga* (several species), *Pedicularis* (several species). The cushion habit is simply this clump forming tendency carried to extremes, so that the clump springs from one rhizome and forms a single unit. More scattered are *Trollius, Scabiosa, Morina, Valeriana, Geranium, Thalictrum; Meconopsis betomcifolia pratensis, M. polygonides* and other species, *Salvia,* certain *Pedicularis, Potentilla, Habenaria, Lloydia, Fritillaria* and most *Compositae, Umbelliferae, Gramineae* and *Papilionaceae.* The dwarf rhododendrons are however the most notably gregarious plants in this zone. Above 11,000 feet there is little competition between species; the formations are mostly open. But there is competition between formations—a vegetative rather than a floristic competition. It requires very little additional shelter to turn an alluvial fan with an herbaceous flora into a belt of scrub, or to cover a scrub belt with trees. And in a region so dynamic such changes take place comparatively rapidly.

The most characteristic feature of the scrub belt is the enormous accumulation of snow in the main valleys, due to avalanching from the high cliffs on either side. At intervals the cliffs are split by deep gullies, and it is down these chutes that in the early months of the year the snow is shot, to pile up in beds from 20 to 50 feet thick in the valley. These snow beds survive till far into the summer. Small wonder that alpine plants are found so low as 9,000 feet. One curious result follows. Snow beds continue to melt even at 13,000 feet, till September or October in secluded valleys, whose higher slopes have for months been gay with flowers. As fast as the snow melts, seeds germinate and plants hitherto held back, start into growth at its edge, looking like flotsam left by the ebb tide. I have seen *Iris Delavayi,* which normally flowers in June, in full bloom in October at the edge of a snow bed whence it had lately been released. Snow beds occur as low as 10,000 or even 9,000 feet, but these are normally melted by June or July. Above 14,000 feet, the snow beds never completely melt—they are permanent snow-beds, which were once glaciers, but have since gradually dwindled till the pressure is no longer sufficient to form ice. These permanent snow beds help to keep the valleys cold, and the alpine flora in cold storage. The most striking example of their delaying action I have ever seen was in the Gamlang valley in October 1937. At an altitude of about 13,000 feet a big snow bed still filled the valley, which here ran east and west. The snow had long since disappeared from the south slope above the bed, which was covered with alpine plants in ripe seed, including *Primula sikkimensis, Iris Delavayi, Nomocharis pardanthina, Meconopsis betonicifolia, Trollius, Polygonum* and other plants. Across the valley, less than 100 yards distant, where the snow was still slowly melting on the north slope, all these plants were in fine bloom looking as fresh and brilliant as though it were June instead of mid-October. Such plants which have been in cold storage all the summer, ready to burst forth the moment they are released (though often stunted as a result of the brief growing period) must not be confused with the genuine autumn flowering species such as *Gentiana gilvostriata* which normally flower in October-November.

From what has been said it will be realised that above 11,000 feet the growing season is short, the winter long. In the north where the Rhododendron Scrub zone is chiefly developed, snow lies for at least five months, not melting before June or July on sheltered slopes. On exposed slopes however, it is loosened and slides into the valley, covering up fresh ground. However plants growing on the exposed scree gain little by this device, suffering from shortage of water, which is constantly supplied on the sheltered slope by the slowly melting snow. Thus the average growing season is only about five and a half months (June-November).

Some rhododendrons flower as early as May, while still partly under the snow, but of course their flower buds were ready formed. The herbaceous alpine plants mostly flower during the height of the rainy season (July-August). Many *Compositae, Labiatae* and Gentians flower in the autumn (September-October) the last named though frozen stiff at night, frequently lasting in full bloom into the bright November weather. Undoubtedly the early summer is the Rhododendron season, early autumn the Gentian season—a point which the botanist, who is also a horticulturist will not miss.

The following is a list of Rhododendrons found between 11,000 and 13,000 feet in North Burma:—

RR. Beesianum, anthopogon, campylogynum, calciphila cerasinum calostrotum* chryseum, crebreflorum, hypolepidotum, eclecteum, keleticum* luridum, niphargum praestans, pumilum, pruniflorum, repens, saluenense, selense, sanguineum, tephropeplum, trichocladum, chamaetortum* arizelum, tsarongense.* Those marked with an asterisk are endemic.

Other endemics in this zone are: *Meconopsis violacea*: *Cremanthodium Wardii* and *C. Farreri.*

XIV. ALPINE TURF AND SCREE.

There is no really satisfactory definition of an alpine plant. Alpine plants are usually associated with mountains and glaciers. But just as glaciers in high latitudes descend to sea level, so also do alpines. However though alpine plants may defy definition, there is no doubt about the alpine region and the alpine flora in low latitudes like North Burma, where the necessary conditions occur only at high altitudes. In the remote regions of Alpine Turf and Scree along the rugged tops of the high ranges, no trees grow; even shrubs are scattered and stunted, but an occasional undershrub may be found nestling under a rock, almost as high as vegetation ascends. Plant formations are open, except occasionally where a sort of thin turf exists, or in rarer patches of meadow. Few herbaceous alpines are gregarious, but some species of primula (e.g. *P. melanodonta*) occur in solid drifts, containing hundreds or even thousands of plants, when in bloom visible a mile away. I have never seen in North Burma however the myriads of primulas one sees in the alpine meadows of Tibet, or in the Assam Himalayas. (*P. alpicola* in the former; *P. Dickieana* and *P. Kingii* in the latter; none of these species have been found as yet in North Burma).

Individual alpine plants descend far below the tree line growing either in screes formed at the base of crumbling cliffs or colonising boulders in the torrent bed. In neither case do they have to compete with trees. But there is a limit below which they never descend; they have an individuality of their own as alpines. Rarely one finds an alpine which has strayed down a high North Burma valley so low as 8,000 feet, far from its accustomed haunts. (I once found a solitary plant of *Nomocharis pardanthina* not a very typical alpine, though it usually grows under alpine conditions, at 8,000 feet in the Adung valley.) At 9,000 feet one notices a few alpine or sub-alpine rhododendrons of more or less dwarf habit, generally colonising boulders, where there is only a film of soil. At 10,000 feet alpines are fairly numerous on screes, cliffs and exposed or soilless places generally, and in meadows occupying silted up lake beds or swamps and on river banks. It is not however till we reach 12,000 feet and forest begins to fail completely, that alpines, whether herbaceous or woody, dominate the landscape. Above 14,000 feet woody vegetation virtually ceases, but scattered herbaceous perennials persist for another thousand feet. Between 12,000 and 13,000 feet herbaceous alpine plants are found in every type of habitat in crevices of cliffs, on screes, on boulders, in the stony beds of streams, lining the high gullies, as well as in sheltered dips and hollows. They are annual, biennial or more commonly short-lived perennials. A few cliff dwelling species with woody rootstock are long-lived perennials.

Six specialised vegetative types occur :—

(*i*) *Mat plants.*—The creeping much branched stems form a thin spreading mat moulding itself to the form of the rock or soil, e.g. *Diapensia himalaica*, which forms a closed mat. Some of the prostrate *Gaultheria* from open mats. *Gentiana Wardii* forms a kind of mat. Amongst under shrubs, species of *Salix* and *Rhododendron* form definite mats, e.g. *R. repens.*

(*ii*) *Cushion plants.*—The short stem branches repeatedly, internodes are suppressed and the telescoped shoots, closely pressed together, form a solid hemispherical cushion in which the flowers appear like pins stuck in a pincushion. Cushion plants, e.g. *Arenaria polytrichoides* generally grow amongst loose boulders.

(*iii*) *Rosette plants.*—Internodes are suppressed, the leaves, lying flat on the ground, form a green collar surrounding the central mass of flowers. Mostly confined to Compositae which have exactly the right type of inflorescence to profit by the idea, eg. Crepis, Lactuca Saussurea, a few Umbelliferae, also Geranium. The Crucifer *Pegaeophyton* though semi-aquatic might also be regarded as a rosette plant.

(*iv*) *Woolly mantle plants.*—Stem and leaves are enveloped in long cottony or woolly hairs. From a little distance such plants sometimes look like a pyramid or ball of white fluff. *Saussurea gossypifera* and other species and *Cnicus* sp. belong here and in a lesser degree, *Eriophyton Wallichii.*

(*v*) *Bulbous plants.*—Only *Fritillaria Roylei, Lloydia, Nomocharis* and one or two *Allium* produce bulbs. The soil is too cold and perhaps too wet for this type. Several orchids have pseudo-bulbs.

(*vi*) *Woody rootstock plants.*—These grow in cliff crevices. There is a thick woody rootstock clothed with the bases of old leaves and an immensely long tap root. The rootstock gives rise each year to a bunch of flowers and leaves, e.g. *Paraquilegia grandiflora, Potentilla peduncularis.* A quarter century seems no unusual age for such plants.

A fair number of alpines conform to one or other type; on the other hand, many species of *Primula, Pedicularis, Cremanthodium, Gentiana, Saxifraga, Iris* (the last two are inclined to form compact clumps and perhaps clump-forming might be counted as a seventh vegetative type)—*Pinguicula, Corydalis, Polygonum, Pleurogyne,* to mention a few make no visible concession to austerity. One can hardly argue that therefore adaptation is unnecessary, for who can say that in another 5,000 or 50,000 years the unadapted plants will not have completely disappeared, leaving only the well adapted? We may note in passing that biennials like *Meconopsis violacea* are rosette plants (unflowering) in their first year and so to speak annuals in their flowering year. As their seeds do not germinate till about May, and they are scattering their ripe seeds by October year, their life is confined within about 17 months.

Shrubs found in the high alpine region are chiefly dwarfed forms of those which occur in the zone below. *Salix, Juniperus, Rosa servicea, Potentilla fruticosa* at lower altitudes, and rhododendrons of the 'Lapponicum', 'Saluenense', 'Cephalanthum' and 'Neriiflorum' type and *Cassiope fastigiata* at higher altitudes. Several (endemic and near endemic) species are characteristic of the alpine zone, e.g. *R. calciphila, R. riparium, R. crebreflorum,* together with *R. repens, R. chryseum, R. sanguineum, R. saluenense* which are more widely distributed in Sino-Himalaya. As to *R. chryseum,* in Yunnan and usually also in North Burma, the flowers are, as one would suspect from the name, yellow, but a form occurs in the Adung valley, indistinguishable from typical *R. chryseum* except that the flowers are a deep plum purple. These two colour varieties cross freely in nature giving a whole range of charming apricots, salmon pinks and other shades.

The most conspicuous herbaceous families represented are: *Compositae, Boraginaceae, Rosaceae, Papilionaceae, Umbelliferae, Renunculaceae, Orchidaceae, Gramineae, Cruciferae, Crassulaceae, Cyperaceae, Caryophyllaceae, Primulaceae, Liliaceae, Gentianaceae, Scrophulariaceae, Saxifragaceae, Papaveraceae, Fumariaceae, Polygonaceae* : and the most numerous and notable plants met with are species of *Primula, Omphalogramma, Corydalis, Polygonum, Meconopsis, Anemone, Paraquilegia, Ranunculus, Draba, Caltha, Androsace, Gentiana, Arenaria, Lloydia, Pedicularis, Alchemilla*

Leontopodium, Erigeron, Anaphyllis, Luzula, Pegaeophyton. Nomocharis, Iris, Cremanthodium, Saussurea, Aster, Saxifraga, Eriophyton, Cnicus, Gaultheria, Mortensia, Potentilla, Geranium, Vaccinium, Epilobium, Euphorbia, Viola, Diapensia.

Perhaps the most typical habitat in the alpine zone is the scree, where at least half the known alpines grow. Screes are the product of a dynamic climate, where destruction of rock is greater than transport, resulting in accumulation of debris. The scree flora proper is the best expression of vegetation in the highest zone and is specially adapted to its mode of life.

A scree is a section of a cone, with a slightly convex profile. The apex of the cone is directly under the cliffs, the base in the valley, the whole being fan-shaped. The largest fragments roll furthest, hence at the base is a boulder bed, while the apex is dust. Thus the scree flora is stratified and decreases in size and variety from base to apex. At the base, there is a thick growth of undershrubs, which rapidly thin out upwards to be succeeded by a film of green, which gradually disappears and the upper part of the scree consists of rock dust only.

Amongst the boulders at the base of the scree grow species of rhododendron (*R. trichocladum* and others), *Lonicera, Spiraea*, thickets of dwarf bamboo, clumps of *Polygonum Griffithii* and other plants. Higher up comes a fairly thick zone of herbaceous plants, *Fritillaria, Compositate, Gentiana*, and a thin mat of prostrate *Gaultheria. Primula capitata* grows here, with *Cremanthodium, Eriophyton Saxifraga.* Higher still the vegetation wears thin, and presently peters out. On sheltered slopes however there are more rhododendrons and they persist to higher altitudes.

There is one character common to nearly all scree herbaceous plants, and that is a very long tap root. The need for it is obvious when we consider the structure of a scree which has an average slope of about 50°. The plant has to probe deep for water which rapidly sinks down into the loose material. It has also two anchor itself firmly in a substratum which is ever sliding. For this reason, the root often forms a T-brace. Screes occur mostly on the exposed side of the valley, or on both sides where the valley runs north and south, though a very slight tilt will serve to protect a slope from the rapid melting and sliding of the snow in early summer. which makes all the difference to its vegetation.

After the screes, the commonest habitat is the cliffs. Most of the rock in North Burma, above 12,000 feet, is granite or similar crystalline rock able to support very little vegetation. Great areas of cliff are utterly bare of plant life; even lichens. Occasionally, as at the head of the Seinghku valley limestone is met with supporting a more varied flora. On the whole the high alpine region is more remarkable for the numbers of plants of certain species than for variety. In the highest zone, the vegetative season is exceedingly brief, and only those plants which are fully adjusted to this fundamental fact can survive there. There is no Spring properly so called. Growth begins when the snow melts, literally, be it in May or in October, and ends with the coming of fresh snow in

November. Endemics are few. They include *Primula fea, P. triloba, P. chamaethauma, Pedicularis nana.*

XV. SUMMARY.

North Burma comprises the headwaters of the Irrawaddy and of its main tributary the Chindwin, included between the parallels of 25° and 28° 30′ and between the meridians of 94° 30′ and 98° 40′. It is a mountainous region covered with heavy evergreen forest, and has been very little explored. Originally a plateau (the 'Irrawaddy Plateau'), during the Pleistocene glaciation it was covered by an ice sheet, which drove out the Pliocene flora. Some of this flora probably escaped southwards and south-eastwards, down the Burma-Malay mountain arc. Meanwhile glaciers were ploughing out great valleys, and the dissection of the plateau was completed by water.

Following the retreat of the ice several streams of flora entered Burma from the south, south-west, south-east, and probably from the north-west also. An Indo-Malaysian flora spread up the valleys, a Chinese flora spread from the east and south-east, a Sino-Himalayan alpine flora established itself on the high ground.

Not many alpine endemics have been discovered, the Sino-Himalayan flora having spread far and wide over the mountains between Kashmir and China. But at lower horizons numerous endemics are found of Chinese and also of Indo-Malaysian affinity, particularly between about 4,000 and 9,000 feet altitude.

The flora of North Burma is an astonishingly rich one; it has undergone great vicissitudes of climate, has travelled far, and the present flora must have become stabilised in North Burma in comparatively recent times.

Eight major climax formations are recognised and three minor ones are regarded as subdivisions of the Temperate Rain Forest. Two other minor climax formations, found within the Mixed Temperate Forest zone may be no more than local associations.

It is believed that the flora is changing continuously as the many rivers cut deeper and deeper into their valleys and the Indo-Malaysian flora creeps northwards.

Certain highland areas of North Burma, such as Saramati peak, Ka-Karpo-Razi, and elsewhere in the 'Triangle' have never been touched by the botanist, and it is felt that valuable additions to our knowledge might be gained by visits to these places.

The literature of the country is scanty, and since almost all the principal collections[1] are to be found at the Natural History Museum London[2], the Royal Botanic Gardens, Kew, and the Royal Botanic Gardens, Edinburgh, a keen investigator could quickly get abreast of what is known, and add much to our knowledge.

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[1] The Vernay-Cutting collection of 1938-39 from the Htawgaw area, comprising about 500 numbers is in the Herbarium of the New York Botanical Gardens. It was described by Dr. E. D. Merrill and others in Brittonia, December, 1941.

[2] My collection of 1937, containing about a thousand numbers, was partially destroyed when the Botanical Department was hit by incendiary bombs during the 1940 'blitz' on London.

XVI. LITERATURE.

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CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA

BY

A. St. J. Macdonald.

(*With 2 plates and 2 text-figures*)

Part VIII

(*Continued from page 47, of volume 45*)

Sea and Estuary Fishing.

Estuary fish (1). Sea fish (2).
'Angling Around Bombay' by G. D. Traylen (3).
'Note on Sea and Estuary Fishing at Karwar' by Dr. M. Suter, D.SC. (4).

From Karachi in the extreme north of the West Coast of India to Cape Comorin in the south, then again all along the East Coast of India and down the Burma coast to the Mergui islands, excellent sport can be had, both at sea and in the tidal portions of the rivers, with Game Sea Fish of considerable size.

It is a subject little dealt with, but one that provides excellent sport, and is as good as in many parts of the world.

Those who seek fuller information are referred to the *Rod in India* by H. S. Thomas, and to the following Journals of the Bombay Natural History Society :—

Vols. 12 and 13. Six articles by Commander Gadsden, Royal Indian Marine :—(1) The Bahmin, (2) Mullet and Gar-fish, (3) Aden and adjacent waters, (4) Andaman Islands, (5) Karachi, (6) Open Deep Sea Fishing.—All are informative and helpful as to seasons, localities, methods and tackle.

Vol. 17, No. 3, p. 620. Estuary fishing, etc., and habits of Nair fish.

Vol. 17, No. 3, p. 637. Protective Legislation for Indian Fisheries.

Vols. 24 and 25. Sea fishing in the Persian Gulf by Major Lane.

Vol. 33, No. 2. Iist of 369 species of fresh and salt water fish found in Travancore and the sea off its coast, with vernacular names.

Vol. 34, No. 4 and Vol. 35, No. 1. A series of most interesting and informative articles by Sir Reginald Spence (Hon. Secretary) and Mr. S. H. Prater (Curator to the Society) on the Fish Supply of the West Coast of India.

Vol. 36, No. 1. Game Fishes (freshwater) of Bombay, Deccan and in Bombay Presidency, by the same authors.

Vol. 42, No. 1. 'Something about Swordfish' by Lieut.-Col. R. W. Burton.

Vol. 41, No. 3. 'A Visit to the Laccadive Islands' by Lieut.-Col. R. W. Burton.

I give below a short description of the best known fish with their habits and the ways of circumventing them.

I. ESTUARY FISH.

BEGTI : Lates calcarifer. B. vii.

D. 7-8 1/11-12, P. 17, V. 1/5, A. 3/8-9, C. 17, L. 1. 52-60, L.Tr. 6-7/13, Caec. Ply. 3.

Dangera, Sind; *Nuddeemeen* or *Nairmeen,* Mal.; *Paineomeen* or *Koduwa,* Tam.; *Pandukopa* or *Pandu-meenu,* Tel.; *Durruah* and *Bekkut,* Ooriah; *Begti,* Beng.; *Nga-tha-dyk,* Arrac; *Koral,* or if large *Baor,* Chittagong; *Todah,* Andam; *Cockrup, Bagti* Calcutta. *Nair* Madras and Bombay, and commonly known by this name.

Lates calcarifer attains a length of 5 feet and a weight of 200 pounds. Dr. Cretin gives the colouring as 'Grey, shot with green above, silvery below during the monsoons, with a tinge of purple'.

The mouth is armed with minute file-like teeth. They are sea fish, but found with the Bahmin frequenting the Estuaries. They have a humped back, and are caught on spoon or better still the small grey mullet, which they relish, and is the most killing bait. The live prawn also is an excellent bait. It is claimed that owing to their nocturnal habits and large eyes they are to be taken in coloured water, so this should not deter one from fishing for them. They are very game fish, and the heaviest of tackle (same as for heavy mahseer) should be used. They are an excellent table fish and provide the chief fish supply for the large towns of Calcutta, Madras, and Bombay.

Spin your bait slowly and rather deep, as he takes the bait in a slow matter of fact way. The best time to fish for the Nair fish is in the middle of the day and in coloured water; in the case of clear water, fish from sundown onwards. They are easily located by the loud splashing that goes on while they are on the feed; in fact this is the indication to stop, as after they have ceased breaking the surface of the water, you can abandon any further hopes of catching them.

RED PERCH : Lutianus roseus. B. vii.

D. 10/14, P 16, V. 1/5, A. 3/8, C. 17, L. 1. 48, L. Tr. 57/50, L. Tr. 7/18.

A small fish running to 5 pounds. Colour given by Dr. Cretin, 'dark reddish brown becoming dull cherry red below'.

Also caught by spinning with lighter tackle in smaller water near the banks, breaks water quietly, and his dark form can be seen rising near rocks.

BAHMIN ; Polynemus tetradactylus. B. vii.

D. 8 1/13-15, P. 17 iv. V. 1/5, A. 2-3/15-17, C. 17, L. 1. 75-85, L. Tr. 8/14. *Coec pyl.* many.

Habitat; Seas of India to the Malay Archipelago and China, Colour is given by Dr. Cretin 'white filaments on breast, silvery green above, yellowish below'.

This species may attain weight of 40 pounds. Day's '6 feet and upwards in length' is very doubtful. This is the best of the

Estuary fish from a sporting point of view, besides the gamest looking. The mouth is set below with the upper portion carrying the nose very prominent, with a bold large eye. The mouth is armed in a similar way to the Nair fish with very fine file-like teeth, which are unfortunately a protection against a good hook hold. It is a very powerful and game fish, as its shape would

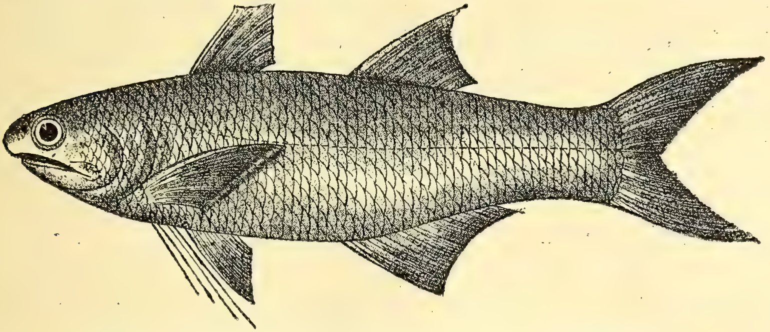

Fig. 1.—The Bahmin (*Polynemus tetradactylus*).

indicate. It lies in the back waters and swift runs where the water is forced through a bottle-neck at either incoming or outgoing tide, and where they can take the small fish at a disadvantage.

Col. Osborne, who Thomas quotes as an authority on these fish, mentions that they are to be taken in the eddies and near piles and piers of old wooden or iron bridges, where the water is broken and the swirls and eddies are a certain find. He also states that it is very important to first detect these fish feeding, which is easy by the splash they make on the surface sending out spray in every direction. The ebb, or flow, of the tide seems to be the indication to start feeding. The young grey mullet is the dainty morsel these fish fancy and provides the best bait for their capture. Thomas amusingly puts the opinions of a number of anglers as the 'Bhamin Committee;' this was in reality the vote of majority on the best time to fish, and it appears that, with Col. Osborne, they agreed that the ebb tide or just after provides the best sport.

He has a characteristic rush like the mahseer and must be given full rights, or a break is inevitable. 'Killin' wire traces and stout mounts and hooks as for heavy mahseer, are imperative if you want to do well with this fish. But be careful as to 'killin', it rusts very rapidly. Bahmin are occasionally taken on spoon, though phantoms and spoon are less productive than mullet, which provides certain sport if the fish are feeding. Here I can do no better than to quote from the 'Rod in India'. of how to fish for Bahmin.

'Having now mentioned rods, tackle and baits, I turn to the actual capture of the fish. As I have already said, when the tide steadies into a regular stream you will, if standing on a bridge soon see the mullet and other small fish darting in different directions and the Bahmeen (Bhamin) dashing after them. Commence spinning at one end of the bridge by throwing out as much line as you can control; let the bait trail and spin in the water, and be careful to spin well over those spots where you have seen the fish rising. Hold your rod with both hands across your chest, with the point rather elevated, and without making another cast walk at such a pace as will keep the bait spinning nicely to the other end of the bridge. And now comes the question, which is the best side of the bridge to fish from? This is an important point. The best side of the bridge is that towards which the stream is running, the reason being that mullet always work up against the stream, and the Bahmeen (Bhamin) always lie in wait for them on that side of the bridge, towards which the stream runs, so that as the shoals of young mullet toil slowly up against the tide and make their way through the arches of the bridge they fall an easy prey to the Bahmeen (Bhamin) which are lying in wait for them and hiding behind the piers and piles of the bridge on the other side. When there are a large number of fish about, they can be caught on both sides of the bridge; but the rule I have as regards what I may call the stream side, should be adhered to'.

Thomas (2nd Edition pp. 208-209) mentions another of the family. This is:—

Polynemus Indicus.

B. vii, D. $8 \frac{1}{13-14}$, P. 15 + v. 1/5, A. $\frac{2-3}{11-12}$, C. 17, L. l. 70–75, L. Tr. 7/13. Vert. 5/19. *Caec. pyl.* many.

'This species has five pectoral rays reaching nearly to the anal fin. Air vessel long and narrow. Vertical fins dark edged. *Habitat.* Seas of India to the Malay Archipelago and Australia.' Day also says, 'It attains 4 feet in length, but is rarely above 20 lbs. weight.'

This is the fish known as *'Dara'* around Bombay, and as Tamil, *Tahlunkala;* Mal. *Yeta*; Mahr., *Bhāt.*; Aarracan, *Lukwah.*; Burma, *Katha*, or *Kaku-yan*; Tavoy, *Kwey-yeng.*

2. SEA FISH.

Five species—The best known localities for sea fishing are the Andamans seas, probably because of the small European community who find it their lot to do three or more years duty in these prison islands, and who turn to fishing as their only recreation. Having no shooting to fall back on, they turn to what proves to be as good sport as any, and a variety of fish of all sizes is taken. Not that I would admit for a moment that it is better than fishing anywhere along the coast from Karachi to Mergui, but we find that most of our information is gathered there, and will serve our purpose, as the baits and methods are the same as for any localities where these fish occur.

The local fishermen will soon put you on the ways of catching and finding the many varieties.

Punjab wire is probably the best for traces with ordinary Catalina line. Large sea reels and Ringal rods provide the tackle with strong hooks to stand up to a bite of a powerful fish, armed with a mouth of file-like teeth.

Sardines (*Clupea longiceps* and *C. fimbriata*) which appear in large shoals at times, are the best bait for the open sea fishing, they are thrown out away from the boat, till the fish are noticed feeding which is registered by swirls; then the liveliest of your bait is attached to the hook and cast in amongst the feeding fish. The presence of these fish is also an indication of the arrival of the Khokari, which follow the shoals and take their toll.

The Seer or Surmai, *Cybium* allied to the Mackerel, grows to 6 feet in length. Colour is given by Dr. Cretin as 'bluish above, silvery below, with blotches. Altogether a sea fish. Scaleless, finlets on back.' They have a large head, and mouth full of formidable teeth. The larger ones are taken well out and away from shore, where 50 and 60 pound fish may be caught, and they put up a grand fight.

Khokari (*Caranx*) (Andamans) many varieties. This is a handsome fellow, perch like in appearance, full and deep body slightly compressed, scales small and resplendent, head small and shapely, high backed with strong tail and fins. The pectoral fins are long and scythe shaped, colour goldish. Body is bluish silvery sheen on the back, to a golden white below, they run up to 100 lbs. or more. They are found in shoals of 20 to 50 with the fish all averaging much the same size, are excellent table fish, and take pride of place as a game fish in the Andaman Seas.

The other sporting fish are all caught in much the same way.

The Barrachuda (*Sphyraena*), (several varieties) or dog-fish, is a good fighter and runs to 105 pounds in weight (West African record): ordinarily the size met with is 15 to 30 lbs.

Gobra (*Serranidae,* sea-perch family) a kind of rock cod. It is shy, ugly and heavy. When hooked it bores down and sulks, and gives endless trouble before it will move.

The Bonito (*Thyanuspe-lamya*) seldom taken, but a game fish, boring right down to the bottom the moment he is hooked.

Mackerel, Grey Mullet, Gar fish are also taken and the usual limit in weight is 10 pounds for the last named.

Tunny, Rays, Sharks, Indian conger eels or Wam (*Muraenesox*), Ghol (*Sciœna*), and Bahmins are also to be had for the seeking, and I can here only suggest to anyone interested to obtain all their information from Vol. xxxiv, No. 4 and Vol. xxxv, No. 1 of the Bombay Natural History Society's Journals. The fish of the west coast are dealt with well, and in detail, therein.

For the Sharks, Rays, and Tunny, Sea fishing books will direct one as to tackle and lures.

I reproduce notes on Angling Around Bombay by T. D. Traylen, on fishing around Karwar by Dr. M. Suter and a note sent to me by 'Munisheh', on Sea Fishing in Malabar,[1] which throws yet another aspect on the methods to be worked through and tried, while fishing for Bahmin, Seer, etc.

3. ANGLING AROUND BOMBAY.

BY

G. D. TRAYLEN.

Of Votaries of the Rod resident in Bombay, comparatively few practice or give thought to this form of recreation, although excellent fishing is within easy reach of anyone seeking it. It may be that it is not generally known, what fish are to be taken, where to look for them, or what gear to use; others again, may possibly have made an attempt, but owing to their venture having been made at the wrong time and place, results were not conducive to further trial. In as few words as possible, I will endeavour to write down my experiences regarding: Firstly, the Fish which may be taken, secondly, Places where they may be found and lastly, Suitable Tackle, and Lures.

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[1] Reprinted from the Journal of the Bombay Natural History Society, Vol. xxvii, No. 3, pp. 535-539.

The Bahmin (*Polynemus tetradactylis*), local vernacular, 'Raos,' comes easily first as a really good fighter who gives excellent sport. He takes the lure with a rush, gives several runs, and is not one's fish until actually in the boat, moreover he is good for the table.

Quoting the late Mr. Atalala, as an authority, 'the Bahmin is stronger weight for weight than the Salmon, quite as game and without the vice of sulking'.

The Begti (*Lates calcarifer*), local vernacular 'Dungara' or 'Kajura', known in Southern India as the 'Nair' is another excellent sporting fish.

When angling for Bahmin and Begti one occasionally is taken by a 'Seer'; this seldom happens, as he rarely comes into the estuaries, but the 'Gobra' or Rock Cod, the 'Tamas' a species of bream, the 'Powla' of the Shad family will take the same lure, a small Shark sometimes bolts the bait, and if too near the bottom, a repulsive series of Eel will intrude, and give some trouble in cutting away and bending on fresh gear. I limit further remarks to the Bahmin and Begti, these two fish being best worth attention.

The Bahmin may be taken anywhere in Bombay Harbour and round the Coast, where a strong current runs over rocks. The Shoal at Sunk Rock Beacon is a favourite haunt, but he will be found off the Prongs Light House and in the openings through the reef which extends from Colaba to Malabar point; at the Kansas Rock or Gull Island, the Shoal at Middle ground Battery, at Tucker Beacon, Hog Island, and as far up as the rocks at the Customs, Bundar, Thana, and he no doubt feeds at other places in the harbour where the tide runs strongly over a rocky bottom. Though Bahmin may be present, one never gets a run excepting at the very end of the flow at slack water and during the whole of the Ebb tide.

From August to October he will certainly be in evidence at these times of tide; from November to May he is somewhat irregular in attendance, in June and July he may possibly be present in force, but few would care to venture in the early part of the monsoon, because of Squalls and the heavy combers which roll over the Shoals. Sometimes the Bahmin comes up stream in numbers, and takes voraciously for about an hour or hour and a half, at other times he takes right down to the last of the ebb, so that one need not be discouraged should there be nothing doing for an hour or so after anchoring, for he well repays a little patience. I have already stated that the Begti is occasionally present in Bahmin waters, but in the monsoon months he ascends the creeks and rivers and will be found beyond Kalyan, a good pool for Begti during August and September is near the Railway

Bridge over the Ulhas river at Kalyan going north, *i.e.*, towards Titvala, this pool will be seen on the left hand side of the bridge and near the right bank of the river. A deep channel through the rock opens out into a broad reach, in appearance somewhat like the neck of a bottle, and the pool is just where the neck joins the shoulder. Unless one has a boat it is better to approach from the left bank and cast from the rocks. A small silvery fish which the native fishermen will procure, or a live prawn, floated two to three feet beneath the surface are the best baits, although a spoon or silver devon will answer when the stream runs strongly. Heavy fish of 20 to 30 pounds are taken here. Begti frequent many other places on the Bassein Thana Creek, the rocks where the stream narrows near the Collector's bungalow, Goa Bundar, the rocks in main stream Parsick, the small creek which runs under the Railway Bridge at Mumbra and two places further up that creek, one being the rocks opposite Diwa and the other pool immediately below the stone 'bund' rather less than a mile higher up (it is desirable to have a boat to negotiate this creek). In the main stream from Mumbra to Kalyan there are several rocky shoals, notably one about a mile below Kalyan and another close to the new bridge which leads to Bhiwindi. Undoubtedly the Begti is in the river from its mouth to the higher reaches, and many other likely spots might be found by drifting down stream on the Ebb near low water, taking bearings of those places where rocky obstructions create a rapid stream, for Begti appear to feed near the exits of passages through boulders and in the eddies caused by such obstructions.

The question of Tackle is productive of unlimited controversy, most Anglers have their own theories and favourite rods, but it necessarily follows that as all men are not physically the same, a rod which the one handles with ease would be too heavy and fatiguing for another less robust. When fishing from a boat in salt water, rods are subject to rough usage, and unless one is particularly careful, sun, wind and weather plus occasional collision with the boat or its fixtures and, last but not least, the pull of the stream plus that of the fish will speedily put a perfect weapon out of gear.

The ordinary shop 'Sea Rod' appears to be made especially for the Cod, Plaice, etc., found in home waters, and is no more suitable for Bahmin and Begti than it would be for Bass. Almost any rod will serve providing it is sufficiently stiff to comfortably carry the weight of sinker and lure plus the pull of the Stream. Without deflecting more than about 300, it should bend throughout its entire length, for many rods I have seen in use have had a good top, but being too stiff in the butt joint the result has been a break when the Bahmin has made one of his sudden rushes, or when giving him the butt prior to gaffing. For preference, I would choose a two jointed rod with whole cane butt and green heart top, in length from 8·6 to 10 feet and sufficiently light to enable one to make a cast of about twenty yards with one hand.

If the corkgrip is tightly wound over for about twenty inches, with strong hemp cord, it makes a firm hold in all weathers. In play it should bend in a half circle or more from butt to top, and not merely from middle to top in the form of a hook with a long shank; the reason for this will be appreciated when one is playing a Bahmin whose steadfast purpose is to run under the boat and cut the line, or bore for the anchor rope to the same end. The Bahmin has no teeth, but his mouth has a hard bony ridge serrated like a file and he is frequently held by one barb of the hook catching under this, it is the spring of the rod which secures the hook hold and the hook becomes free as soon as the net or gaff takes the weight of the fish. Too supple a rod is not desirable for two reasons. 'A' one has to remember that frequently the fish are on feed for only an hour or two hours, and too supple a rod means longer time in getting him to net and many chances are lost. 'B' is rather a tax on the good nature of one's companion, if fishing in company, it being expedient that all other lines shall be reeled up when a Bahmin is being played. A good Calcutta Ringal (Bamboo) silk lapped in two or three places in each segment, the butt packed and lapped with good hemp cord for about twenty inches, good brass winch fittings and 'Snake' rings of copper or brass wire (not iron or steel) will render good service. The winch or reel should have a large drum for rapid recovery of line, Nottingham pattern reels with optional check and line guard are excellent, size not less than four inches and five inches for preference; brass lining is desirable as it almost eliminates the chances of a jamb. Those Anglers who have reels of the old pattern with small centre spindle, may get useful work from them, if a few yards of stout blind cord are first wound on the spindle before reeling on the backing line. The importance of getting line back *quickly* when the fish rushes towards, instead of from, the boat when struck, is obvious, especially as one does not know whether or not the hook is fairly home or merely engaged with the hard bony ridge he has in lieu of teeth and gums.

It is desirable to pay particular attention to the business end of the line. *Eschew gut and Gimp*, and mount all hooks on fine steel wirt, for the Bahmin is an adept at gymnastics and his gyrations are fast and furious in his endeavours to bottom and, aided by the rocks, rub the annoyance from its jaws; he will also bore away head down and repeatedly thrash the trace with his powerful tail. This matter may be considered as of vital importance, for unless a good hook hold is secured, all else is of little consequence. Stout 'Eyed trebles' are very satisfactory in use and numbers 3 and 4 the most useful sizes. The hook *must* be stout or it will straighten out in playing an average fish of seven pounds weight. A very useful method of mounting hooks, is to twist a loop in a short length of steel wire, this loop being sufficiently large to pass easily over the eye of a treble and down its shank, the free end of looped wire should be turned twice and secured through the eye of a second treble, so the looped mount should measure over all about one and a half inches from top of loop to top of eye, a pair of round nosed pliers is a useful tool for this purpose and also for bending on wire traces to swivels.

In using hooks so mounted, for Bahmin take an unmounted treble we term the Lip hook, pass the loop of *mounted* treble over the eye of lip hook, the trace is attached to this lip hook, one barb of which is passed through the nose of live bait, and one barb of mounted hook is inserted in the side of bait between the pectoral and dorsal fins. The Bahmin invariably attacks the head of live bait, if spinning live or dead bait the loop of a second mounted treble may be passed over the first mounted treble and one barb be inserted in the bait, midway between the Ventral and Caudal fins, so as to curve and to make it spin. This tail hook should always be used from August to November, as Begti and Seer are then occasionally present, and as they make a rear attack, the lure should be so guarded. Without diagrams, this description has necessarily became somewhat lengthy, but I think the importance of a good hook hold is paramount and the merits of this particular method of mounting is, that it is extremely simple and convenient, moreover, one can depend upon it.

For traces, I do not think there is any thing better than steel wire, 'Killin' wire is very good, and so is the wire from galvanized steel rope, this may be obtained in all sizes, and a six-foot length will provide a number of good traces and hook mounts, besides giving one's servant a little amusement in untwisting and separating it. A useful form of trace is about two feet of stout wire bent on to a double swivel at one end, a single swivel at the other, to the single swivel attach about four feet or less of fine wire the free end being bent on to the eye of the lip hook already described. The Weight or Sinker must not be forgotten, as so much depends upon having the bait at the right depth. The Tide Tables given in the daily papers show the great variations in rise and fall, and the strength of stream naturally varies with the height of tide. A convenient type of weight is an oblong of 2 × 1½ inches with holes at the two top corners through which a length of line folded to from a six-inch loop, one end of the weight, and another loop of about an inch at the other end. The long loop is bent through the double swivel and serves for adding extra weight if required, the free end of casting line is attached to the shorter loop. This form of weight also serves the purpose of an 'anti-kinker' which prevent one's line from twisting. Sinkers may be made of aluminium, brass, and lead; several of different weights are necessary, from aluminium which is extremely light to lead weighing up to six ounces, of course, any other form of sinker will answer the purpose, but the thin metal 'anti-kinker' should not be omitted for in practice the comfort of it will be appreciated. Of lines there are many, a very useful one is a length of about twenty-five yards of number 3 or 4 plaited silk dressed line, bent on to 100 yards of plaited flax backing. One can cast out twenty yards or so of silk dressed line with a turn of the wrist, and the 'anti-kinker' referred to above ensures it coming back without twist, every time.

When using live bait, the boat man will procure such in advance or will catch them with hand lines when the boat is anchored at the place one is angling from; it is always expedient to take a few mullet of about four inches, to provide against a shortage of live bait; they are generally procurable in the bazar and may be spun on the same mount. In August and September a four-inch Silver Devon or a two-inch spoon is possibly the best lure on a strong tide, and live bait or spun mullet if there is a tide of less than six feet. As the bottom over most shoals is particularly rough and scraggy, it is better not to cast when the tide is low and weak, but to use a float to keep one's gear from fouling. The float should be so arranged that it may be easily released when one has a run, a fixed float meaning almost certain disaster.

When the Bahmin is present in force and on the feed, he takes anything going without being particular as to the manner in which it is offered, at other times he has to be searched for and humoured. When the stream is running strongly one has only to pay out line a few yards at a time with a sink and draw motion, the stream carries out the lure, and the Bahmin will make his rush. By this method one is always covering the same stretch of bottom backwards and forwards.

When there are fewer fish about, one needs to cover more ground and search for them, rather than to hang out one's line in the hope that he will come along presently—here let me digress with a note of warning; *never to lay down a rod, with a baited line in the water*, unless first taking the precaution of securing the butt, for at any moment a rush may come, and the rod be snatched from the boat. An effective and killing method of searching water may be explained by referring to the dial of a watch and to assume one's boat is anchored in the centre with the stream running strongly towards 12 o'clock; swing in the bait and let out from 20-25 yards of line, then with the left hand draw in a yard or so of line at a time with a sink and draw motion, coil up line on seat of boat then cast out about 20 yards or so, so that lure strikes the water at about 7-30. The bait sinks with a curve and then rises with a curve at about 10 and swings round to 12. Recover line as before and try the same cast at 5-30, the bait will sink and rise and continue round to 12 again. If not taken, repeat these casts and in successive throws reduce the radius a yard or so at a time, until all the water in ¾ of a radius of about 20 yards near the boat has been tried. If no result, leave line out at 12 o'clock, secure the rod, and rest a few minutes, for it will be fairly safe to assume that no Bahmin are present, otherwise in the area of water covered a touch would be almost certain. Sometimes he takes a devon or spoon immediately it touches water, but in most instances, his rush is made when the lure is rising on the upward curve. One must be particularly careful to *feel* the lure when it is at right angles to the boat, that is about either 9 or 3, as if the current is not strong and the weight is heavy one catches the bottom and this means loss of part of line with its appendages. If one has the bad luck to get so caught, it is sometimes possible to get free, by pulling the line nearly taut and to put the helm over so that the current will swing the boat over the entangled bait, when an upward pull immediately over it, will often effect its release. To get in to the proper position to perform this operation, it may be necessary for the boatman to unhitch and pay out a few more yards of the mooring rope; and it is expedient to be sure this means is provided for when anchoring, as some boatmen would let out all the cable at the start.

Occasionally one will observe Bahmin rising and swirling all round the boat and yet not get a run, at these times plenty of natural food may be in the water, and he has no use for one's carefully prepared lure, however a nice prawn or a small spoon or Silver Devon cast at right angles to the boat, will sometimes induce him to make a mistake.

Sea water is particularly rough on tackle; on returning home it is a good plan to drop all hooks, traces and artificial baits into a basin of water in which a little common washing soda has been dissolved; after a few minutes, remove, drain and hang up to dry, then oil and put away for further use. Line should be reeled off into a tub of fresh water, be left to soak for half an hour and then be drawn through the hand to remove as much water as possible and afterwards be wound on a line-drier and then be left in a draught until dry; unless this is done, line quickly rots. Rusty steel mounts and traces are not safe to use, nothing will emphasise this more forcibly than the loss of a fish which has made a good fight and in the end has gained his freedom through defective trackle.

In conclusion, I might say, few boat-men can be trusted to use the gaff; in spite of coaching they *will* strike at, instead of pull into, the fish. They make better use of a landing net. The average weight of Bahmin taken in the Estuary is seven pounds and fifteen pounds is the limit, out at sea they run heavier. The tackle described and methods of use are not claimed as being the best, they are at least effective in all round practice and ensure sport. At Sunk Rock, one may often observe the Light-keepers haul in fish after fish, by means of a stout pole with a length of signal line to which is attached a yard of stout brass wire, and for lure a six-inch Silver Devon; they are out to catch, and the fish has no chance, but is simply hauled round to the net if well hooked. Any one with almost any sort of tackle will catch Bahmin at times, but there is little satisfaction in going for them with gear which would hold a whale. The Bahmin is a really good sporting fish, he stands up to one and fights to the last and there is satisfaction in knowing that the light strong tackle one is using takes fish when coarser gear does not; moreover, after playing a fish he sometimes gets the best of it and is never ours until he lays kicking in the bottom of the boat, his big eyes seeming to express astonishment at finding himself there. A blow on the head puts him out of his misery, and it is well to remember this, especially if a 'Gobra' comts to the net, as this fish lives for some hours out of water and one is apt to regret should he be bound gasping in the basket when arriving on shore. Bahmin, Begti, Seer and Gobra are quite good for the table, one's friends appreciate *freshly caught* fish and when a good catch has been made there are Hospitals and other Institutions where such gifts are welcome, thus we may have the satisfaction of knowing that although our sport has entailed the taking of life, the victims have in the end fulfilled their natural destiny.

4. SEA AND ESTUARY FISHING AT KARWAR.

BY

M. SUTER, D.SC.

Experience gained in six seasons' fishing and study of fishes at this delightful spot encourages me in jotting down these notes at the request of Mr. Prater, mainly for the benefit of brother anglers, who might find them useful.

Of all places on the West Coast, Karwar is probably scenically the best favoured. The spacious bay on which it lies, with its long and gleaming sandy beaches, is bordered to the south by the rocky and jungle-covered Karwar headland, terminating in Badchidar point.

At the northern end of the bay, where white capped breakers mark the sandy bar off the estuary of the Kalinadi, we find the large islands of Kurmugad and Sungiri, locally called Madlingad.

Kurmugad is well wooded, and crowded with an old fort probably built by the Sounda Rajahs, whereas Sungiri, separated from it by a navigable channel, is rocky and forbidding.

Kurmugad holds a pretty bathing beach and is the venue of a pilgrimage in honour of an aboriginal deity.

The wide vista of the ocean is dotted with a group of several islands and rocks situated about 1½ miles west north-west of Badchidar point in front of which is Elephant island. These islands are about 4 miles from the inner harbour of Karwar and must be described in some detail, as they are the main fishing ground for Bahmin, etc.

The southernmost is just a jumble of rocks locally known as Karkalli. A little to the north-west rises an isolated rock spire, beyond which lies a flat rock-island separated by a channel from the high and well wooded Little Devgad island, which Pilot books appear to call Karkal. It is rocky and foul on all sides, and separated by a channel from the main island, Devgad, which is 140 ft. high, well wooded and carries the lighthouse and other buildings. It has a landing shed and in ordinary times was a delightful picnic place.

To the west of Devgad, and separated from it by a fairly broad and deep channel, we have a rocky island with several prominent rock towers, forming favourite perches of beautiful sea-eagles and the peregrine falcon. This is locally known as Mothe.

A little south of Karkalli there is a submerged rocky plateau from which arises a pyramidal rock, well visible at the halftide. This is locally known as *Burkia*, the drowning place, on account of an old shipwreck tradition.

At the back of the southern end of the bay rise densely forested hills culminating in the rocky top of Gudehally, whose bold outline forms a fitting background to the general loveliness of the picture of the bay, as seen from Devgad island.

Beyond Karwar, to the south-west, lie the pretty bays known as Cemetery and Bingi bays, separated by Baitkal point; and facing Binge bay we have the large and picturesque island of Anjedive, a Portuguese possession, The town of Karwar is a district headquarter with the usual set of Government officers and garrison of district police. There is a market and various shops and artisans, a good hospital, a Dâk bungalow and last, but not least, the Grand Hotel, where Mr. D'Souza provides welcome sustenance and accommodation.

On the various beaches pleasant bathing with or without surf may be enjoyed at all times except during the monsoon, when the surf is too heavy. Sharks keep too far out to be a danger, jellyfish are not more than a very occasional nuisance, and stingrays are evidently quite rare and infrequent visitors of these sands.

From the fishing point of view Karwar suffers by the general disadvantage of this coast. Its very gradual shelving towards the ocean places even such a moderate depth as 15 fathoms quite beyond the reach of the local fishing canoe. This limits the list of available game fish to such predaceous species as come in with the tide in pursuit of shoals of migrating sardines and small mackerel, which frequently hug the coast, perhaps for the comparative safety, of shallow waters.

Thus the angler really depends on visiting fish in quest of food and on such others as use the tidal estuary of the Kallinadi for spawning.

The only true residents of sufficient avoirdupois, worthy of the angler's notice are the Serranidae or Gobras, which seem to be present throughout the year.

Depths of 50 fathoms and over, where one could meet the lovely dolphin, nimble bonito, sturdy yellow-fin tunny, rushing wahoo and lordly sailfish and swordfish, can be reached only by high-powered seagoing motor cruisers, and these fine sporting fish must, on this coast, remain a fisherman's dream for a long time to come.

The tidal nature of most of the local fishing limits profitable activity to a few hours a day, and a further limitation is imposed by adverse conditions of wind and weather. However, these drawbacks, inherent in all coastal fishing, have to be accepted with resignation.

The main element influencing fishing in these parts is the presence or absence of shoals of small fish, such as certain species of *Engraulis, Clupea* and that very tasty little mackerel the 'Bangra'. During their migration, they may or may not enter the bay and hug the coast. These myriads of gregarious fish not only bring welcome supply of sea food to the inhabitants of the coast, but also bring the larger predators within the angler's reach.

Tht main exceptions are such habitual visitors to tidal estuaries as the Bahmin and the Cockup or Begti, the first of which used to provide the chief piscatorial attraction of the region, spawning every October in large numbers up the Kalinadi.

Under favourable circumstances Karwar certainly offers not only an interesting list of hard fighting and beautiful game fish, but also a chance of making catches which can hardly be bettered anywhere else on the Indian coast.

THE FISH.

A short description of the main sporting fish of the region ought to be all the more welcome to the angler, as most of the literature dealing with the subject is nowadays not easily procurable.

By far the larger number of sporting sea fish to be encountered by the visitor belong to two families:—the *Serranidae* or Sea-Perches and the *Scombridae* or Mackerels.

The main exceptions are:—

The Bahmin, belonging to a family of purely tropical fishes, the *Polynemidae*.

The Barracooda or Sea Pike (*Sphyraenidae*).

The Gar fish (*Belonidae*).

The Wolf Herring (*Clupeidae*, genus *Chirocentrus*).

The species of real interest to the sporting angler are the following, given more or less in the order of their importance:—

The **Bahmin** (*Polynemus tetradactylus*). Locally *Rawas* or *Ramus*.

This game and well shaped fighting fish, running in these parts to a maximum weight of 27 lbs., used to provide, for very many years, the main attraction to local and visiting sportsmen. It could be relied upon to appear every year from July to October in schools of a dozen to over a hundred, coming in and going out with the tide.

Whereas the heavier fish frequented by preference the vicinity of the islands of the lighthouse group, smaller ones could be relied upon to haunt the channel between Kurmugar and Madingar islands, and the water outside the bar.

When swarms of 'sardines' invade the estuary Bahmin often cross the bar in pursuit of their prey, ascending the tidal river quite a long way with the tide. They seem then to remain for 1-2 hours just inside the bar at the last quarter of the low tide, offering splendid sport to the expert bait caster.

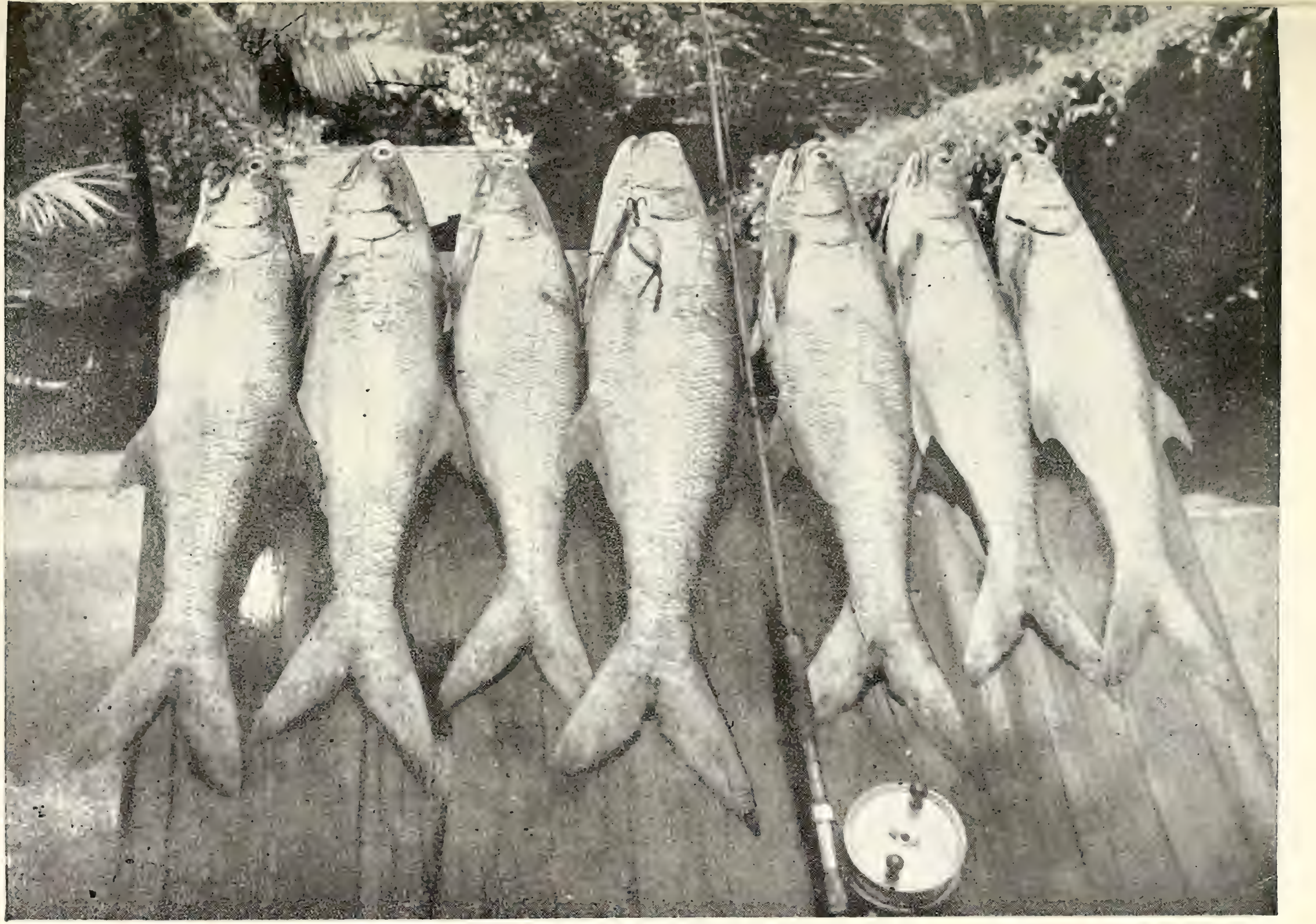
Even as early as end of August, the Karwar Bahmin contain some spawn, which they develop in September, then, sometime in October, they went up-river for spawning.

On completion of this business the swarms evidently disbanded and went out to sea, at all events after October only very rare stragglers have been caught.

Up to a few years ago very fine catches of a dozen and over could be made in a day by a single rod fishing out a tide at the islands. Unfortunately, and for unknown reasons, the influx of Bahmin into Karwar bay has steadily diminished during the last 4 or 5 years, and there were hardly any at all last year. Whether this is due to some catastrophic calamity, or perhaps to adverse conditions affecting their habitual spawning ground such as silting up, must at present remain in the domain of pure conjecture. We can only hope that things will mend again, and we that may look forward to a revival of the fine sport these fish used to provide.

The Bahmin is a finely shaped, somewhat salmon-like fish, with a prominent nose. Its mouth, set well underneath, and provided with large plates of densely packed villiform teeth, offers a poor hookhold, except in the corners.

The eyes, very large and placed well forward, are completely covered by a thick transparent membrane.



Part of a catch of **Bahmin : heaviest** 25¼ lbs. Karwar.

Photo by M. Suter.

The somewhat thickset body and very sturdy caudal region denote speed and power, which this fish indeed possesses to a degree.

The body is fully covered with hard and moderately large scales of a silvery grey colour.

The main distinctive feature of the species is 4 free rays set in front of the pectoral fins which, have given the fish its name *tetradactylus,* i.e. 'the four-fingered one'. There are two separate dorsal fins.

The bladder provides some of the best fish glue, and the flesh is firm, white and very tasty, whether boiled, fried, baked, broiled or smoked. It is one of the best table fish of the region.

Anyone who has ever hooked a 20-lb. Bahmin in open water on reasonable tackle will have nothing but the highest praise for its fighting qualities. Indeed, the speed and length of its initial run are then very satisfactory, and the power and obstinacy of resistance quite surprising in a fish of its size.

Smaller specimens frequently adopt leaping tactics and not infrequently succeed in throwing a poorly placed hook.

Unfortunately schools of feeding Bahmin are rarely encountered in open water, except when there are shoals of travelling squid about. They are more often met with close in to the island faces, preferably in spots where waves break on the rocks and create the lively turmoil, which they love. There they feed on the ever present rock crab and other small fry. In these places the depth is shallow and the bottom a jumble of boulders, densely covered with rock oysters, clams and barnacles. The instinctive and instant reaction of a hooked Bahmin is to dive for the nearest rock and to dash around it, when even a moderate tug suffices to sever one's line on the razor sharp shells.

Disaster is therefore swift and certain if the fish is allowed a run in such a spot. From the moment a strike is felt the fish must be firmly held and dragged away, while the crew pull the boat some 30 or 40 yards into the open, which good men will effect in a few seconds. During this time the line must be allowed to slip out just enough to prevent a break. Once well away from rocks the fish may be played. The necessity for such tactics explains why comparatively heavy lines have to be used. The power of the fish, plus the resistance of its body against this rapid dragging through the water, frequently against a good deal of current, totals up to quite a considerable strain.

It is to be regretted that this dragging process, short as it may be, necessarily deprives any but the most powerful fish of a good deal of fighting power, and fish so caught never show the spirited fight put up by those hooked in the open. They can be brought quickly to gaff. Even so fishermen will appreciate a pause after landing half a dozen good ones.

Hooked Bahmin occasionally seem to go completely berserk, and I have repeatedly known them to beach themselves by running ashore, or leaping onto flat rocks, where they flounder about helplessly.

By far the most glorious Bahmin fishing used to be had by the 'old salts' who turned up in the second half of August, when the sea shows still a good deal of life, and when a really good surf beating against the rocks, creates quite a spectacular turmoil—just what the Bahmin loves!

A good crew will not hesitate to shoot their craft into and through the *tamasha*, yelling at the top of their voices. Great 'whitecaps' threaten to break over the boat or to fling it on the rocks, whilst, only too frequently for the peace of mind of the angler, a yawning blue chasm opens between the brittle craft and the rock. The only thing to do then is to trust to one's luck and to cling to the rod as grimly as possible. The whole thing is a matter of a few most exhilarating seconds and, in spite of frequent dousings, the consummate skill of the crew invariably wins the day, and one emerges from the ordeal with a fine Bahmin as often as not straining at the end of one's line. What, I ask you, could possibly be more exhilarating. Even if one's topee has to be retrieved and the boat to be bailed out now and again, what matters so long as they are biting?

In September and October much quieter conditions are the rule. Nothing exciting may be met with, but occasionally the trip to the islands may resolve itself into a succession of ascents and descents of great, calm and well spaced 'rollers'. Then at one moment the boat seems to be hung up on the top of a ridge, the next moment it is at the bottom of a trough with a steep wall of water in front, another behind, and a bit of watery sky overhead. In fact just that pleasant scenic railway feeling!

THE MACKERELS.

This family provides us with some of the best acrobats and speed-merchants in the medium weight line, but it is unfortunate that the star performers like sailfish and the marlin are out of reach at Karwar, and must be sought for in Ceylon waters or in far away Australia or New Zealand.

However there are several very representative members of the clan to be met with at Karwar. These are:

The **Surmai** (*Scomberomorus commersonii*), Striped Seer fish, Spanish Mackerel; in Kanarese, *Esuvan*.

This is a streamlined tiger of the sea, a true speed-merchant and highflier, which it is an exhilaration to have at the business end of any moderately powered line.

It is a true mackerel in shape, like a somewhat laterally flattened torpedo, sides and head somewhat compressed, the snout coming to a sharp point, the jaws garnished with a goodly array of lancet shaped teeth, the glaring eyes full of the lust of speed and destruction. Villiform teeth are found on the palate. There are two dorsal fins, of which the second is the highest, being falcate and posteriorly concave. The pectorals are sickle shaped and pointed and lie straight above the very small ventrals.

The caudal region, laterally much flattened and attenuated, ends in a caudal fin shaped like a double sickle or a quarter moon. Between the caudal and the dorsal fins, as well as between the caudal and the anal, rows of about 10 finlets will be found.

The scales are minute and inconspicuous. In colouration the fish is in the main silvery, shading to purplish and green tints along the back and the upper parts of the head. The greenish black stripes which embellish the sides are not conspicuous in life, but become so soon after death has set in.

This is a fierce and extremely predaceous fish, travelling in schools of a dozen to a hundred in pursuit of prey, which they follow with the tide sometimes into fairly shallow water, and not infrequently quite close inshore.

To watch them smashing up a shoal of travelling *bangra* is a real sight. Sometimes a dozen or more of these long white shapes skyrocket to heights of 12 or 15 feet and coming down head first with a resounding smack into the middle of their densely packed prey, smashing and stunning them, gobble them up at leisure. It is a truly amazing procedure.

The Surmai has none of the snagging propensity of the Bahmin. Most of its fight is generally near the surface. When at all large he will, *if allowed to*, produce a lightning run of up to 100 yards or over and frequently end this with a series of quite spectacular leaps. I have never seen this truly magnificent performance equalled by any mahseer I ever hooked. Size for size it is only surpassed by the Wahoo. In his tactics the Surmai resembles the mahseer, not only in the spectacular first run, but also in the cruising, which so often follows, and the rest of the performance seems rather tame after the truly exhilarating start.

Unfortunately the Surmai that approach to within the angler's reach seldom weigh much over 30 lbs., whereas in deep waters, such as those of Queensland, they surpass 6 ft. in length, and reach a weight of up to 150 lbs.

It is a delightful table fish, when not too large, worthy of the best effort of a good mackerel cook, and ought, by rights, to be washed down with a glass or two of some racy white wine.

Surmai visit Karwar at any time after the middle of October, whenever a sufficiency of their favourite food fish is present in the bay, rather than further outside, and they continue to do so well into the hot weather.

Their presence is soon betrayed by their leaping tactics and there ought not to be much blind fishing or trolling for them.

The Spotted Surmai (*Scomberomorus guttatus*).

Much of the description of the Striped Surmai applies to this closely related species, except that it is often not quite so slenderly built as its relative, and is covered on the sides with a number of darkish spots. In general its dimensions are more modest.

It follows the same tactics as its striped cousin, and is an equally esteemed table fish, which may reach 3 ft. in length or over and weigh 20 lbs. or more.

They do not appear to visit Karwar as often as their cousins. Weight for weight they seem to be as good and nimble fighters as the preceding species.

The Horse Mackerels (*Caranx sp.*), *Koker*.

This is quite a large tribe comprising some very large species and some very small ones. They are all deep-set fish with large heads ending in somewhat blunt snouts, with the lower jaw rather pronounced. They are armed with conical and also villiform teeth. Their bodies are well covered with very small scales, even the opercles getting their share of this protection.

There are the usual two dorsal fins of the mackerel tribe, and the pectorals are generally long and sharply falcate. The caudal region is strongly attenuated, and the posterior third of the lateral line provided with a series of hard armed plates.

In colour they are mostly silvery, frequently with a light golden sheen, and in some of the smaller species most of the fins are a very bright yellow. The caudal fin is a sharp double sickle. Two of the larger species at least are regular visitors to Karwar, i.e. *Caranx gallus* and *Caranx hippos* and there may be others.

One of them is known to local Mussulmans as *Sidibai*, the 'negro woman', on account of its thick lips.

They may run well over 60 lbs. and are then quite formidable opponents requiring a good deal of skill and judgement in being brought to gaff. However, those caught locally will not very often exceed 40 lbs. Even these give a very hard fight on moderate tackle.

Their tactics are not very spectacular, but as indicated by their shape, they are strong and speedy, certainly very tenacious and do not give in easily.

The first run of a *Caranx* is made at an almost incredible speed and invariably directed slantwise for the bottom.

It would be perfectly futile and quite fatal to one's line to try and interfere with the rush of a large *Caranx* in its initial stage. It far exceeds anything I have ever experienced from mahseer.

It is only in the later stages of the run that cautious application of the brake is permissible, if the fish is at all large.

It will then try various tactics and contest the efforts of the fisherman very bitterly and for quite a long time, keeping game to the end.

When gaffed and drawn inboard, many of them give vent to a pig-like grunt, whence their Indian name.

It is to be regretted that really large *Caranx* are by no means very frequent visitors to Karwar, whereas they seem to be present at the Malwan rocks and at the Vengurla lighthouse island during every monsoon and sometime after in goodly numbers.

Some of the smaller species are lively and gay little fish, frequently met with as they cruise about in small bands on the surf, often doing the porpoise act.

They are quite fierce predators and even half-pounders sometimes commit suicide by seizing a 3-inch spoon.

Small Caranx are quite excellent eating, specially the Yellow-finned variety, but the large ones are quite unfit for the table.

The Queenfish (*Chorinemus lysan*); locally: *Dagoli.*

This is a very fierce and game looking mackerel, with a curved and projecting lower jaw, a very widely cleft mouth, large and fierce eyes and a laterally very compressed body. The caudal fin is large and deeply lobed, and the pectoral and anal are falcate.

In life this fish is a beautiful silvery colour, shading into bluish towards the back. When dying a beautiful golden hue begins to

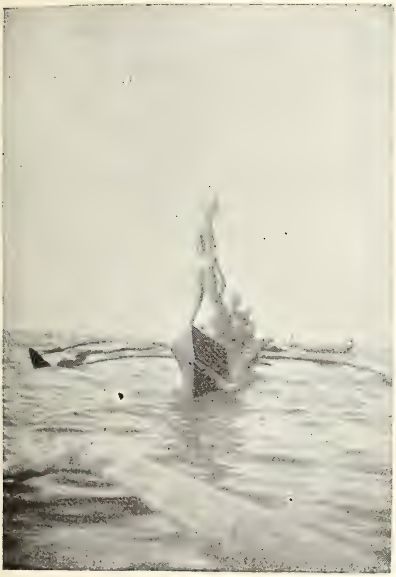


Fig. 1.—Outrigger canoe. Karwar.

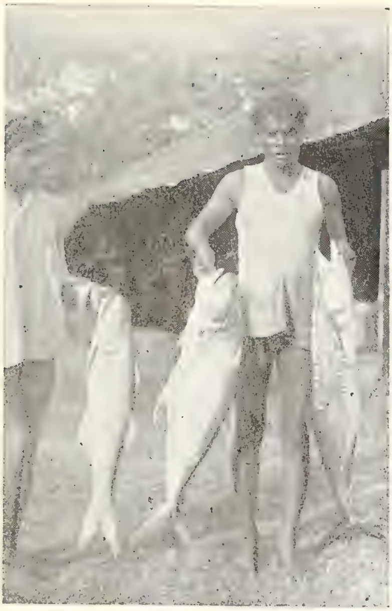


Fig. 2.—Bahmin, Dagol and Surmai. Karwar.

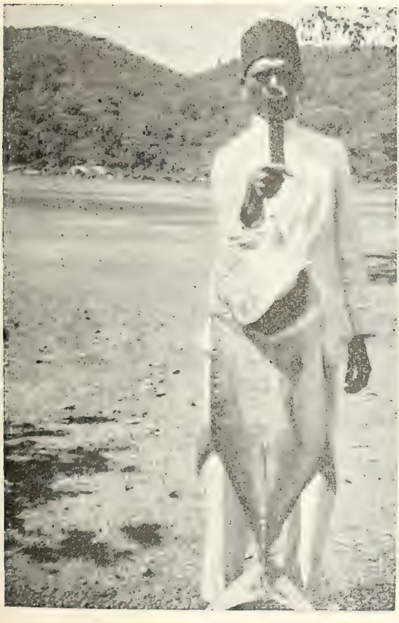


Fig. 3.—Caranx: 40 lbs. Karwar.

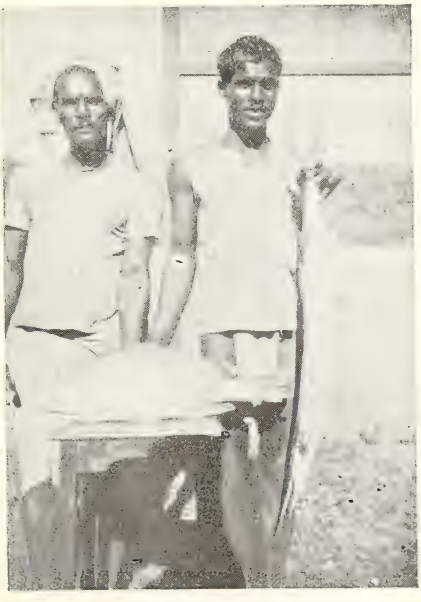


Fig. 4.—Red Rock Perch: 11 lbs.
'Toli' or Needle Fish: $7\frac{1}{2}$ lbs.

form all over the belly and sides. This golden colour intensifies gradually and persists quite a considerable time.

About five large round spots, the size of a crown piece are discernible along the lateral line. They are not very conspicuous during life but show up very prominently after death.

These spots are responsible for its Indian name.

There do not appear to be any very reliable data as to the maximum weight attained by this fish. It appears, however, to reach 50 lbs. round about Natal. At Karwar, a 35-pounder would be a very large one.

They are exceedingly fierce and predatory, and easily distinguished from the Surmai by their way of attacking a shoal of *bangra*, invariably from underneath, never attempting any 'smashing' tactics.

A successfully hooked Dagoli gives a glorious run on reasonable tackle, if not treated brutally, as is quite often the case with beginners. They are quite strong, and although not as tenacious as the *Caranx*, will not easily summit, and quite as often as not, will give several very decent runs.

A 35-pounder, foulhooked in the throat, once took 150 yards of 36-lb. line off my reel in an almost incredible run, at the end of which it jumped and thrashed about wildly on the surface.

I always considered it a privileged occasion to have a large Dagoli at the business end of a comparatively light line and a rather whippy little rod.

Although this fish is quite often caught on a spoon, my impression is that it really gives preference to bait, well and skilfully presented. I have also caught them in Ceylon waters from a motor launch, i.e. at Barbryn and at the Kalpitiya lagoon with Japanese feather squid.

The Queenfish, although very fond of the *bangra*, appears to relish even more a small, whitebait-like fish called locally *Buratty*, about 2 inches long, which sometimes visits the bay in large numbers, densely packed in little shoals. When these visit the place the Queenfish is sure to follow.

A somewhat smaller cousin of the Queenfish makes an occasional appearance and two or three of them took my spoon. This is very probably *Chorinemus toloo*. It does not seem to reach much over 18 inches in length, and is, therefore of no particular interest to the angler, but it is a much better table fish than its larger cousin the Dagoli whose flesh is soft and rather insipid.

The specimens of this smaller fish, I caught, appeared to me to be distinctly deeper, i.e. not so slender in a vertical sense, than the Queenfish. They were very white with a blue back, and had 6 small dark spots along the lateral line.

Chorinemus tala, which Day describes as bright orange with orange coloured fins, and which is said to reach 2 ft. in length, may also occasionally appear as it inhabits the same waters as the two preceding ones, but I never came across it.

The Black Kingfish *(Elacate nigra)*; *Morwasa.*

An elongate and fusiform mackerel, laterally not so markedly compressed as its cousins already described. The mouth is wide and the head rather broad and flattish, giving a somewhat murrel-like impression, quite unlike the head of any other mackerel.

It is armed with rows of villiform teeth and covered with minute scales. The two dorsal fins are of the typical mackerel type, the rear one, rather high and pointed, often emerges from the water when the fish is cruising. The caudal is large and crescent shaped, the lower lobe being the shorter. The pectorals are falcate and rather long.

The Elacate is dark olive in colouration, almost black in the upper parts and whitish along the belly.

It gives an impression of power and speed, which the large ones certainly do not belie.

In books of reference this fish is always figured by the picture of a very immature specimen, probably taken over from Day's book of *The Fishes of India.* This is quite unlike the adult and useless for the identification of a fully grown specimen.

The *Morwasa* or perhaps better *Mudhwasa* is a very worthy opponent, having besides, the special attraction of reaching a very considerable size. Specimens over 70 lbs. are by no means really rare. It does not appear to be as fiercely predaceous as the other mackerels, but puts up a good and stubborn fight initiated by a fast and long run. Really large ones streak off like lightning when struck, and give a great deal of trouble, before giving in.

They show no marked tendency to snagging one's line, even when caught in spots where they could easily accomplish this.

These fish seem to appear later in the season than most others and are one of the principal attractions to anglers operating in November and December.

Also they appear not to be so purely tidal in habit as other large mackerels, seeming to remain in the deeper parts of the bays, markedly so in Bingi bay, during any part of the day.

They are very often caught on set lines at night.

As a table fish the *Morwasa* has nothing to recommend it being coarse and not tasty.

When they make an appearance in numbers in the bay, they do not seem to ever club together, but are met with singly.

The stretch of water from Badchidar point to Karkalli rocks and the water off the lovely little 'Ladies beach' or 'Reti bunder' are then good localities where a really large one may be trolled for. They are also occasionally hooked when fishing for Surmai or Rawas roundabout the islands, and I have come across them close in to Karkalli rocks, when the tide was very low.

Having thus exhausted the list of large and sporting members of the mackerel tribe, we now turn our attention to the other main family of fish, inhabiting these waters, namely the *Serranidae* or Sea Perches. The king of these, from the angler's point of view, is without any doubt that doughty warrior, known as:

The Cockup (*Lates calcarifer*). *Begti; Nair Fish, Kajoora.*

This is a powerfully built, high backed, perch, with the typical fin outfit of the tribe, the first dorsal being provided with thick and pointed spines, pectorals and ventrals broad and somewhat blunt, while the great caudal, affixed to its very muscular tail, is broad and rounded. The posterior dorsal has only soft rays, whereas there are seven spines in the anterior. The mouth is very large, with a prominent lower jaw, and is well armed with villiform teeth on jaws and palate.

The scales are moderately large and the general colouration is greyish silvery, shading to dark greenish gray on the back.

This is a typical estuary fish frequenting the tidal waters of nearly every large river, and the waters outside the estuary.

They ascend tidal rivers right into sweet water quite frequently and may indeed be used for stocking freshwater lakes without apparent inconvenience to them.

This fish is one of the most esteemed table fish and of considerable economic importance in many parts.

It frequents Karwar Bay as well as the Estuary, but does not seem to be really numerous. For this reason it is caught by anglers, just occasionally by pure luck. Nobody has as yet taken the trouble to find out the habitual haunts, if any, it frequents by preference. A closer investigation of rocky spots in the river would be well worth undertaking with a view to discovering the feeding grounds of this fish.

Netters occasionally make a good haul of Begti of 30-40 lbs., as I once witnessed near Burkia rock, where I had trolled just a short while earlier, without having even experienced a touch.

The Begti has no predilection for a spoon, though it has quite often been caught on one. A dead bait cunningly presented to it, or better still a live bait such as a very large prawn or a lively mullet have proved much more killing.

Begti have been caught in the Kalinaddi along the large Casuarina plantation on the far side of the river just below Sadashivgad.

On another occasion I observed a very large one chasing small fish a few yards from shore at the 'ladies beach', but had, unfortunately, no casting tackle handy.

The Begti, in contradistinction to most sea and estuary fish of any size, seizes its bait not with a rush, but mouths it gently and must be struck, for which there is no necessity with any of the mackerel.

This fish may reach great weight, much over 100 lbs. under suitable conditions.

Anyone willing to go deeper into the habits and capture of this fish at Karwar will deserve the praise and gratitude of the angling fraternity.

The Gobras or Gropers, also known as Rock Cods are the giants of the family. Some of truly fantastic size have been caught in various tropical and semitropical seas.

In Queensland, specimens of 600 lbs. and more are not uncommon and are the nightmare of the trochus divers, who fear them far more than sharks. At Karwar the lighthouse keeper once landed one measuring more than 7 ft. length and 5 ft. in girth. It was covered with barnacles and a most fearsome monster. Its remains served as manure for the new coconut palms of the island.

During the monsoon netters have occasionally landed similar giants. When trolling deep in the channel between Devgad and Mothe islands towards evening using a *bangra* for bait, I have on two occasions hooked and played monsters of at least man size, but never succeeded in landing one.

The best known of these monsters is :

Serranus lanceolatus.

A very thickset typical perch, very variable according to age and surroundings in colouration and markings. Young ones are often mottled brown on a gamboge ground. These colours dull with age. Adults are generally brownish above, shading into grayish below, and irregularly blotched over with reddish brown.

Serranus malabaricus and *Serranus salmoides*, which is probably synonymous with *Serranus diacanthus* also occur all along this coast.

They are, however, so similar to *S. lanceolatus* that they need not be given a special description in an article of this kind.

All these gobras are provided with enormous heads and huge gaping mouths, a set of conical teeth in the lower jaw and a large number of villiform teeth on jaws, vomer and palatines.

When gaffed they distend their opercles and inflate themselves, making their heads look quite leonine and menancing. The first dorsal has short and very stout spines, the second only soft rays. The pectorals, ventrals and anals are broad and blunt, often spotted, and the caudal is broad and rounded.

The paunchy body is covered with small scales.

These fish seem to be permanent or nearly permanent residents of these parts and not influenced by tidal conditions. They are great predators, but do not seem to chase their prey in the open sea like the mackerels. They apparently lurk in rock caverns and amongst boulders, to pounce on the passer by, whom they engulf in their cavernous jaws.

Owing to its purposeful skill in snagging one's line in a short lightning rush to the nearest rock, the gobra is a most detestable fish to hook. Having effected this first manoeuvre it quietly sits down behind its rock like a goonch, and earnestly applies itself to the severance of your line, in which it is much assisted by the presence of sundry mussels, burnacles and clams, with which the rocks are well covered.

The novice, not up to the wiles of his opponent, and finding his line whizzing out with the speed of the boat, not infrequently thinks he is fast in a running fish, and wonders at the endless run he is experiencing. 'Old hands' invariably recognize a gobra by its first and immediate reaction to the strike. The thing they do is to stop the boat and take it as nearly as possible right over the anchorage of the wily fish, circling slowly round, tugging all the while. This generally succeeds in dislodging the fish, which then tries to reach another near by refuge.

By repeating this procedure as often as required even quite large gobras may be circumvented, provided the line holds, which is by no means invariably the case.

At all events the usual gobra of 30 lbs. or under ought to be landed, as fish of this size can be pretty roughly handled without actual risk of breakage, provided one's line is not frayed and one's rod tip plays up well.

Small gobras are quite good eating, and have appeared on many a Bombay man's table under the name of 'ishtone fish, suh.' ! Chinese connoisseurs esteem them greatly.

A few small members of the gobra family inhabit the locality and will be mentioned when treating of the activities of the bottom fisher—whose main catch they usually provide.

On the other hand several members of the allied family of the *Lutianidae* or Rock Perches, will quite often take an interest in a trolled spoon or bait.

They are sturdily built and often splendidly coloured perches, and frequently of very reasonable size. Indeed several of the fraternity may reach and exceed 30 lbs.

As indicated by their thickset, highbacked bodies, and determined mien, these fish are powerful and stubborn fighters for their side, ever ready to snag and cut one's line. They should, therefore, be handled with great firmness and circumspection if disaster is to be avoided.

Their relative strength has frankly astonished me on more than one occasion. Size for size, our friend the mahseer is simply not in it.

These *Lutianidae* are very much fiercer in their resistance.

The main members of the family commonly met with at Karwar are the following:—

The Red Rock Perch (*Lutianus roseus*); Tambosia.

This is a truly resplendent fish, clad in fair sized scales of auroral or rosy pink hues, with deep scarlet reflexes in the darker parts. In general shape it is much more elegant than a gobra, although somewhat thickset and humpy. The fins are also more elongate and of a more pleasing shape. The head is large, as is the mouth, which is armed with a few very respectable conical teeth.

This fish does not frequently exceed 7-8 lbs. at Karwar, but much heavier ones have been landed. It is astonishingly strong, and at first leads one to believe that something much larger has been hooked. The sight of its brightly pink body suddenly emerging out of the blue depth is quite a surprising apparition.

Like its fellow Rock Perches, the Red Perch is a great hand at snagging.

These fish sometimes invade the bay in vast numbers and then stay on for many days, during which they are met with wherever there are rocks to suit their fancy.

It is firm fleshed, perhaps a little coarse, but pleasantly full flavoured and very nice in a 'mouli', or as one item of a 'bouillabaisse', that most unforgettable French fish soup.

The Blue-spotted Rock Perch (*Lutianus argentimaculatus*) Kadori.

This is a very sturdy, powerfully built rock perch, reaching well over 30 lbs., according to the literature. The heaviest I weighed was 27 lbs.

Although not so gorgeous as *L. roseus*, it is a very pleasing sight fresh out of the water, with its greyish, silvery ground colour, shading to darker hues in the upper parts, and ornamented as it is with several not too clearly defined vertical blackish bands and innumerable small, caerulean spots.

This fish is certainly expert at snagging, and applies its enormous strength very determinedly. Many are the lines that it has broken in a super-lightning whizz round a well barnacled rock. *L. argentimaculatus* seems to be more of a free lance than *L. roseus*, and does not seem to associate in large bands, and seems to be happy in little bays where a certain amount of surf keeps beating on the rock face. From the culinary point of view it is a most desirable catch.

The kalasis of the lighthouse are great hands at fishing for them, but loose many more than they land on their handlines.

The Tamboos (*Lutianus* spp.)

Lutianus johnii also a sturdy fish, but less highbacked than the preceding ones. It is more sober in hue, being generally olive brown in the upper parts and yellowish in the lower with purplish and golden flushes, and a prominent black spot in the rear part of the lateral line. It frequently ascends tidal rivers and is said to reach up to 5 ft. length. The heaviest I weighed was just under 30 lbs., 15 lbs. is a common weight at Karwar. These are quite fierce fighters and amazingly strong when of good size.

Lutianus sillaoo.

Brownish red in the upper parts and often vinous, but a fine deep lake below the lateral line. On the throat and chest it may have scarlet reflexes and orange on the opercles.

This fish is also said to grow very large and is frequently found a long way from the sea up tidal rivers.

It is excellent eating and greatly esteemed by the population. I have never had the good fortune to hook a large one, but judging by the resistance put up by the 3-5 pounders I handled I must have missed something worth experiencing.

Lutianus fulviilamma. This member of the family may or may not be ornamental with a black spot above the lateral line. It is frequently vinous red in the upper parts with pink flashes, and the lower parts have a beautiful golden sheen. This beautiful fish does not appear to visit the bay very frequently, but I have occasionally caught it at the south-western end of Mothe island, when it gave a most excellent fight. The largest weighed 17 lbs. and was very good eating. They took a spoon quite readily.

The genus *Sciaena* is represented mainly by :—

The Gol fish (*Sciaena sina*)

This is a very familiar fish to the inhabitants of Bombay, who frequently see them carried about on the heads of nimble little Koli women. It is a fine representative of the *Percidae*, rather more slender and elongated than those treated previously.

The body is covered with moderately large scales, brownish in the upper parts, greyish white below.

These fish reach 50 lbs. and over and appear sometime in September in vast congregations in the bay. They are easily spotted by their habit of lying up closely packed, almost at the surface, forming a large purplish patch.

Several boats then sally forth with long nets in which they encircle the shoal of fish, gradually tightening the circle, until they have them in a bag between two boats.

The catch, which frequently amounts to over 600 fish in one haul, is taken ashore, cleaned, gutted, salted and sun dried on rocks.

The finished product used to be bought up by Moormen from Colombo at amazingly low rates for disposal to the plantation labourers in Ceylon, as a welcome addition to their diet. These merchants were, however, so grasping, that in certain years the local fishermen stood firm and refused to fish for gol.

The gol, a fast and tenacious fighter, is caught on rod and line only as a piece of very occasional luck.

It is rather coarse but quite tasty.

Having reviewed the main members of the two great families of the *Scombridae* and *Serranidae*, and treated that superb game fish the Bahmin, we now have to say a few words about the local representatives of a few other less prolific families, with which the angler may come into contact.

The local representative of the *Sphyraenidae* is :—

The Barracooda (*Sphyraena jello*); Banasia.

This is a true sea pike, bearing a fair resemblance to our fresh-water pike, with whom it shares the spare and elongated body and the very predatory mouth full of pointed teeth. In many areas of its extensive range this fish reaches a length of 6 ft. and a weight of 60 lbs. and over. It has a bad reputation for ferocity and is greatly feared by bathers in some parts.

In Karwar, they are occasional visitors never reaching anything like full size. Amongst the many I caught, the largest did not exceed 16 lbs. and was a mere baby compared with some I came across in Ceylon and Australia.

These small barracooda are after all mere undesirables. They come in like lambs, are in the habit of vomiting up the contents of their stomachs in the boat, and as table fish they are detestable.

A large one, no doubt, does put up a much better show, but size for size cannot compare with surmai or dagoli.

The local member of the *Scombresocidae* of interest to the angler is

The Garfish (*Belone annulata*) Toli.

This is an extremely elongated and very slender fish with a very long and thin snout, like a gavial, full of needle pointed green teeth. The dorsal and anal fins are situated very far back, in fact just before the tail. The pectoral and ventral fins are very small as are also the scales.

The colouration is rather bright, the back being sea green and steel blue, the sides pale greenish shading down to white, and the lower jaw frequently black.

The Gar is chiefly remarkable on account of its long jumping performances. It will suddenly shoot out of the water, like an arrow from a bow, to a height of about 5 ft. and a distance of 20 to 30 ft., and repeat this several times, just barely touching the water between leaps.

The local representatives, rarely much over 2 ft. long, will occasionally take a spoon, but much prefer a dead bait rapidly drawn over the surface. This is in fact how much larger specimens of the genus are circumvented in the Seychelles, where a flying fish is trolled from a motor boat.

As a table fish it is not to be despised.

The only member of the great herring tribe of any interest to the angler at Karwar is

The Wolf Herring (*Chirocentrus dorab*) Karli

The fish reaches colossal dimensions in the Pacific, where it is credited with a length of 12 ft. It never seems to exceed 4 ft. in our waters.

A very elongated and laterally very compressed fish, with an underhung jaw and a mouth full of very pointed and sabre shaped teeth. All fins, with the exception of the caudal and the anal, are very small, and the dorsal is situated very far back. The scales are small. The caudal fin is deeply forked.

The colouration is quite striking, being bright silvery with a beautiful ultramarine blue along the back.

This very predatory fish appears often in numbers of mostly undersized individuals. They are then almost equal in nuisance value to the abominable scabbard fish, mauling and tearing up one trolled dead bait after another, making fishing in waters which they infest almost impossible.

However, when the larger ones come, they may be observed swirling on the surface and even leaping as they feed on sardines.

Then is the time to rig up one's little tubular steel rod and level winding reel and to cast them a little plug or a cunningly mounted dead bait. Quite pretty play, with a few acrobatics thrown in, will ensue and furnish the delighted angler with a welcome change from the eternal trolling.

The fish is unfortunately full of sharp little bones, but otherwise quite tasty.

Strips of its tough and white hide make quite good trolling baits, the entire fish is one of the most favoured baits used in Ceylon by swordfish anglers.

Finally I might yet say that I have ample evidence of the presence, some 15 to 20 miles further out, of such very desirable members of the mackerel family as the dolphin, the bonito, the yellow-fin tunny, the wonderful sail fish and the marlin, which are at present quite entirely out of reach. Perhaps the day may come. . . . . ?

It is now necessary to give a short list of the fish to be procured by such methods as *drift lining* and *bottom fishing*.

The first mentioned method, i.e. drift lining or *surf lining* from an anchored boat, will quite often procure quite interesting results. This form of fishing is not often indulged in by visitors to Karwar, as it is most fruitful in channels with a rapid tidal flow towards and after sunset, such as the passages between Badchidar Point and Elephant (Mogeragudda) island, the one between Devgad and Mothe, and the channel between Kurmugad and Badlingad.

Apart from various rock perches, such as *Lutianus roseus* and *argentimaculatus,* caught on medium-powered driftlines baited with chunks of *bangra,* with now and then a *gobra* thrown in, we caught on light lines floated in the surf of small indentations, the pretty *Diagramma crassispinum,* and in the tidal current *Hemiramphus limbatus* both of which take a prawn's tail well enough.

On large chunks of *bangra,* very large rays and an occasional dogfish may be caught.

On occasions the fun was interfered with by incursions of the very detestable *Trichiurus malabaricus,* the Scabbard fish, which drove everything else away, and one had to pack up and leave the place.

Of the fish mentioned above,

Diagramma crassispinum, locally called *Amboi,* is one of the most interesting on account of its qualities as a table fish. It belongs to a separate genus of the *Serranidae* or *Sea Perches* and is a sturdy and deep set fish in a pigeon grey uniform of small scales. Its main characteristics are the very stout spines in the first dorsal, and a particularly thick one in the anal, and above all the very thick and fleshy lips, which in Queensland have earned it the name of 'Sweet lips'.

It may exceed 20 lbs. but most of those caught by drift lining are quite small.

Hemiramphus limbatus is one of a number of very curious garfish like *Scombresocidae,* characterized by a much produced lower jaw, forming a kind of beak. The body is slender and sub-cylindric in section, clad in scales of moderate size, coloured greenish with blue sheen above, shading down to white below.

In contradistinction to the lower jaw, the upper is very small. The dorsal fin is single and stands opposed to the anal in the posterior part of the body.

These fish do not exceed a foot in length and often appear in large numbers, when they are eagerly sought after owing to their excellent culinary qualities.

When they are on the feed the fun is fast and furious and they can be taken in rapid succession, cast after cast.

Trichiurus malabaricus and its relation to *Trichiurus savala* belong to a separate family, the *Trichiuridae* or Scabbard fish. They are aptly described by their local Marathi name '*Bale*' the spear. Their characteristics are a very slender, laterally compressed, elongated body, with the dorsal fin running nearly the whole length of it. There is no caudal fin, but the body ends in a sort of thin rat tail. The ventrals are practically reduced to nil and the pectorals very small. The muzzle is elongate and the mouth very wide and furnished with a goodly array of pointed teeth.

These fish are apt to appear now and again in considerable numbers, when they are a frightful and abominable nuisance, destroying and maiming little fish literally in thousands, i.e. far more than they could ever devour, evidently in sheer bloodlust.

At times I have seen the inner harbour of Karwar full of swarms of small mackerel (*Toki*) everyone of which was more or less gashed or mutilated by these pests, and in an evident state of helpless terror. It was quite a pitiful sight indeed.

Trichiurus is a great nuisance to the troller using a bait fish, as they slash these up time after time and render them useless.

It is most inadvisable to sally forth after sunset in a canoe, wearing a white shirt or singlet, numbers of *Trichiurus* are then about and they are quite likely to leap at a white arm or shoulder, inflicting a painful bite. My tindal Genoba experienced this much to his discomfiture in my presence, when such an attack left him bleeding profusely and very sorry for himself. *Trichiurus* is eaten but not greatly esteemed.

The ray most commonly caught by drift lining is the Leonard ray probably **Pteroplatea micrurae** a large ray with a somewhat rounded disc, white below and covered above with dark and light spots and blotches. It has a long whip-like tail furnished at the base with one or more, flat dagger-like spines, up to 8 inches long, with a finely serrated edge, with which it inflicts very painful and dangerous wounds.

They are rather fun to catch, as they make off rather slowly but with great power and determination and take quite a bit of hauling before they can be brought alongside. It is a queer sight to see these great flat things emerge from the depth into the starlight, belly up and looking just like a white blanket.

We caught them up to 70 lbs. and over. They are cut up and sundried in strips, and are said to make quite a palatable stew.

Fish caught by bottom fishing.—This is mostly done from an anchored boat, in spots well known to the boatmen, who often practise it. It is most successful at sunset and after, and is mostly performed with handlines, baited with prawns or chunks of fish.

The main bag is composed of whatever small or medium sized gobras may be about.

At times some of the *Lutianidae* will appear in numbers, and form part of the haul. *Diagramma crassispinum*, the Amboi, is often caught, as are one or two members of the *Sciaena* family.

Other, but very unwelcome familiars are the various murrain eels, hideous creatures which tie themselves round the line in a slimy ball and inflict a very painful bite, unless care is taken. They are extremely pugnacious.

A short description of the following will suffice. Amongst the minor gobras we meet:

Serranus fuscoguttatus, covered with rusty yellow spots.

Serranus undulosus with a number of dark longitudinal lines along the sides.

Serranus commersonii, a lively little fellow with longitudinal black line above the lateral line, much fished for by boys along the quays.

A very much better fish is that very good eating perch known as The Palu. This is a thickset pearly grey fish, with sturdy spines in dorsal and anal fin, running to 3-4 lbs. It is much esteemed as a table fish and has the reputation of being the champion bait-thief on the West Coast.

It is found in fair numbers also in tidal rivers and in estuaries.

One of the *Chrysophrys*, a pretty little fish resembling the Palu, but more whitish and having bright yellow pectorals, perhaps *Ch. datnia*, is also not infrequently caught.

By far the most welcome catches are the *Lutianidae*, chiefly *Lutianus roseus* and *L. argentimaculatus*, which have already been described. Amongst the eels the following are common:

Muraena tessellata, a flattish eel with a large head, beautifully marked with black spots separated by narrow white lines.

Muraena tile, with a yellowish ground colour forming reticulations between numerous dark blotches.

Muraena undulata. Marked with numberless little brownish spots and blotches on a pale ground, and there are probably others.

Fishing

Having described the locality and the fish available it is now necessary to give a few hints as to the best spots where fish resort and the best methods to circumvent them. These hints will be found useful by the novice and may save even the expert some time and disappointment.

Fishing seasons. It has already been hinted that fishing at Karwar depends to a very great extent on the presence of swarms of migrating fish, such as certain *Engraulis, Clupea* and small mackerels, chiefly *Scomber microlepidotus*, the Bangra. Shoals of these migrants travel along the coast from September well into the hot weather in one direction or the other, and when they hug the coast closely, as they often do, they not only provide the population with food, but attract all the larger predatory fishes, which otherwise keep far outside.

Signs of the presence of these larger fish are then quite unmistakable. The disturbance caused by their attacks on the shoals, results in spasmodic leaping which sends the spray flying.

Or great and gleaming white fish will be seen leaping high into the air. Fishing is then more or less at sight, and may be possible all over the bay and the adjoining inlets, wherever these signs are reported from.

During the time preceding the arrival of the shoals of small fish, i.e. in the second half of August and early September, when the main run of Bahmin and large Caranx generally takes place, fishing is almost entirely confined to the waters in close proximity to the various rocks and islands, and to the channels between them. The fish visit these feeding grounds regularly, coming in and going out with the tide.

For this reason, and according to general experience the best times for fishing roundabout the islands are:

(1) From the end of the first quarter of the incoming tide to the beginning of the third quarter.

(2) From the beginning of the second quarter of the outgoing tide to some time past the half tide.

This rule is of course not absolute, as stragglers often visit the rocks at the high tide or at the extreme low one.

However, most of the fish, at high tide, scatter inside the bay, where they are difficult to find, while at low tide they, as a rule, prefer to retire further out to sea, as is but natural and logical in such a shallow coastal region.

Sometimes, when the fish have left the islands of the lighthouse group at the approaching high tide, they may be met with again near Kurmugad and Madlingad islands, which lie nearer to the estuary.

I have more than once experienced this. During the Bahmin season attention should be paid to the sporadic appearance of shoals of small cuttlefish, which form one of their favourite foods and which they pursue in open waters. An angler's dream!

Swarms of minute, whitebait-like creatures also appear at times and are inevitably followed by the very desirable Dagoli, which is quite inordinately fond of them. Local fishermen call these small fish 'Buratti'.

Methods of fishing. As for the methods of fishing, by far the most successful is that rather tiresome process-trolling, so little relished by the fresh water angler, and which in less lively times means little more than a blind quartering of the area and utter boredom. Relief may come from the occasional sight of a family of otters gambolling in a little bay, or by such diversions as the appearance of a school of porpoises or false killers, or by the swoop of a sea eagle on an unsuspecting sea snake. There should however, not be too many such days.

Where to fish. During the Bahmin and Caranx season the search for fish should be narrowed down to the rocks and islands, commencing with the isolated rock called 'Burkia' where Caranx are often encountered.

Then proceed to the Karkalli rocks and keep your eyes skinned for swirls or leaps round about both ends, and also along both faces, particularly in the shallow bay on the seaward side, where there is often a pretty little turmoil of surf. Troll as close in to the rocks as you dare or as conditions permit, and you may be rewarded by a strike.

If this proves barren, then visit the single rocky pyramid a bit further towards little Devgad, the water between this and the flat stone table island on the far side.

Immediately to the west of the pyramid is a small area of shallows, formed by sunken rock, where usually a good deal of surf obtains. This is frequently a sure find for Bahmin, but exceedingly snaggy. Proceed then to the channel separating the rock-table from little Devgad island, it often holds a fish.

The water on both main sides of little Devgad is almost never tenanted by anything else than gobra and may be given a miss.

Proceed then to the south-eastern end of Mothe island, at the entrance of the channel. If a surf plays at this spot it is tenanted just as often as not. Then proceed up the channel along Mothe Island. Mark the spots where the surf is liveliest and give them the once or twice over. This island face is one of the favourite feeding grounds of the Bahmin. The northern end holds them rarely, but has provided some very fine Caranx, and is often visited by sharks.

The western or south-western face of Mothe holds, just past the south-eastern end, a rocky shallow bay where I have had at times great sport with smallish and very lively Bahmin.

The face of Devgad island, opposing Mothe, is not a favourite with Bahmin, but is visited by huge Gobras, and a little indentation in it with a good deal of surf is a favourite spot for *Lutianus argentimaculatus* of good size.

The north-western end of Devgad is formed by a slanting rock-table in front of a high rock wall. There is generally a strong surf there washing far up the flat rocks. Here some of the really large Bahmin, the 25 Pounders, etc., have been caught. This spot is followed by a roomy and deeply indented bay forming a great part of the north-west side of Devgad island. It is rather shallow, but occasionally tenanted by smaller Bahmin. At the far end is an outlying single rock, between which and the island there is a rather shallow passage where the turmoil of waves is often so savage, as to render it quite impassable. This passage is a favourite spot, as are the rocks beyond it, which form the north-east end of the island. However, a tremendous surf break so often over these rocks in August and September, that often they are not as approachable as one would like them to be.

At the eastern face, just past these rocks, we find a bay in which is situated the island's well, surrounded by a few coconut palms.

This bay is a good find for Gobra, *Lutianus argentimaculatus*, and the face of the island, from this bay up to the entrance to the channel separating it from Little Devgad, is very often a good place for Bahmin.

The channel separating Kurmugad from Madlingad and the small rocky islet at the north eastern of Kurmagad are often tenanted by bahmin, but hardly ever big ones, especially later in the season, i.e. early in October or late in September.

Trolling. When trolling in such localities, i.e. close to a rock-face and over fairly shallow water with a bouldery bottom, a short line of some 20 yards is mostly ample, and really an advantage. A fish can more easily be controlled on short line than on a long one. In more open water, 30 yards of line out should be considered normal. On calm days and very clear water an additional 5-10 yards may be given in the open. It is convenient to mark these lengths on the line with a whipping of coloured silk.

It is a good plan with all lines to be used in trolling in snaggy places to double them at the business end over a length of a few yards, and to affix an inch of whipping at intervals of about 2 ft. Quite often one part of the doubled line may be frayed by contact with a rock when fighting a fish, and the situation yet saved by the other. This is permitted by the rules of most sea fishing clubs and should not be neglected.

With the slow motion oval spoon generally in use, or with dead bait, anti-kink device is not rigorously essential.

With hogbacked spoon and some of the so-called self-striking spoons, which have a rapid motion, it is however, quite essential to use a good anti-kinker in the interest of an expensive line.

A boat-shaped trolling lead may be used when it is desired to troll deeper than the usual 3-4 ft. This is a useful plan when trolling for gobra or rock-perch. Leads of 3-4 oz. will be sufficient. When trolling with an 8 oz. lead and a large chunk of fish south of Mothe island I once hooked an enormous fiddle ray (*Rhynchobatus*) and played it for quite a while. Ultimately I lost it, not altogether to my regret as it was far too large to ship in a canoe.

The face of Karwar head up to Badchidar point may be neglected from the trolling point of view until the end of October, after which the deep part just off the Ladies' bay often is tenanted by *morwasa*, which also seem to like the space between Badchidar point and Burkia rock. In both these stretches a lead sinker may be used.

The channel between Badchidar point and Elephant island (Dukri) is often a hunting ground of dagoli and surmai and may be trolled for them. Elephant island often attracts fairly large gobra, and the rocks off its western or south-western side are occasionally visited by bahmin, as is the seaward side of Anjediv island, especially the south-eastern end, where very often surmai will waylay a shoal of bangra. Anjediv is, however, far afield for a canoe based on Karwar, but canoes may be hired at Bingi village.

Bait-casting tactics with a good surf casting outfit, or even a stout mahseer outfit, provides very enjoyable and quite exciting sport whenever bahmin are found to be feeding in the estuary. Suitable spots are just behind the bar, alongside an extensive Kasuarina plantation, just below the fort hill of Sadasnivgad, on the far side of the Kalinadi.

The fish will be noticed swirling and leaping, often within a few yards off-shore, and the water is almost entirely free of snags there, except for a few stumps closer inshore.

These bahmin are frequently quite ravenous and just take anything cast to them:—spoon, plug or deadbait, with the greatest alacrity. The first rush of a good one, aided by the tide-rip is truly magnificent and may be fully allowed in this snagfree stretch.

Most of these bahmin, although very rarely large, fight wonderfully well, and frequently in their fury beach themselves by running on to the sands, where they leap and flounder about until grappled by an attendant. This is highly necessary as they often rid themselves of the hook and disappear with a leap into the briny.

Opportunity for this glorious fun occurs at intervals during September-October, but it is as a rule confined to the last quarter of the low tide and so never lasts long.

It is therefore advisable to brief a watcher on the spot, preferably one possessed of a cycle or furnished with one, to bring immediate *khubber* when a shoal of bahmin has entered the estuary. The fish frequently enter the estuary at night and may then be fished for at the next low tide. I have never known them to be on the spot more than 3-4 days in succession after which they may be absent for a week or so.

True surf casting is the method least tried at Karwar, where the waves break too far out on most beaches to allow of it.

It might prove successful at the Cemetery bay, at and near full-tide. Sport with rays and dogfish is quite on the cards there, and I shall certainly give it a try at my next visit. At nearly every other spot the slope is so gradual that it would be useless to try.

A few more purely technical hints about actual fishing may be helpful and therefore follow.

With most of these sea fish a strike is unmistakable and not unfrequently produces a jerk, which almost tears the rod out of one's hand. Should the strike materialize anywhere in the immediate vicinity or rocks, as it mostly does in Bahmin fishing, and no immediate ocular demonstration follow, as is produced by such surface fighters as surmai, dagoli, or morwasa, a very firm hold should be kept on the line by means of any braking device provided on one's reel. The line should be allowed to slip out by inches only, while the boat is pulled into open water. The time needed by a good crew is not more than a few seconds. Nevertheless it would be fatal to stop the line altogether. The fish are extraordinarily powerful, and the process of dragging a fairly large body out, often against a strong current, develops a considerable strain, which might easily cause disaster to rod or line.

When playing a fish, except one of the surface fighters mentioned, it is advisable at all at times during the fight to keep a really tight line without however being brutal.

This is first of all rendered necessary by the ever present tendency of gobra, bahmin and *Caranx* to snag one's line on the nearest rocks, and secondly because of the poor hookhold offered by most parts of a bahmin's mouth. Quite often no real hold is effected and the fish can only be played by constant tension. It will drop off the hook as soon as it is gaffed, and the tension ceases.

Very frequently a surface fighter is hooked near rocks. When this is unmistakably the case, the fish may be allowed its run from the very start, as neither dagol, nor surmai or morwasa are likely to snag one's line intentionally. They make straight for the open water.

Such fish should never be held hard, but kept running on a moderately tight line only. A hard hold would deprive the fisherman of the possible thrill of a lightning like rush of 100 yards or over. Only then, a tighter hold may be applied, and the fish struck. When dealing with bahmin it is advisable to strike at the end of the first run, to increase the chances of a good hookhold.

With surmai and dagoli the necessity is debatable.

Runs of the length stated above are never put up by even the largest bahmin. They confine themselves to moderate runs at great speed, invariably in the direction of the nearest rocks. These rushes are generally followed by a series of very strong tugs and sometimes leaps, after which the usual cruising and circling will follow, until the fish can be drawn in to gaff. Watch the fish warily at this stage as the possibility of a sudden dive for a rock is always present, or it may suddenly rush straight at the boat in an attempt to pass underneath. This must be foiled by all the available tactics of rod and boat, as it would inevitably end in a smash up.

An experienced angler will immediately recognize a gobra by its short superspeed dive for the rocks close at hand. It is short, swift and quite unmistakable. The tactics given earlier under the description of the fish should then be applied.

A slantwise rush to the bottom at incredible speed and often over 60 yards or so, indicates a large *Caranx*. The strength of these fish as developed in this first rush is so incredible that it would be the height of folly to do anything except prevent an overrun. A gradual increase of resistance is not permissible until the speed of the run shows some slowing down.

In the pursuit of surmai or dagoli, in the act of smashing up shoals of food fish, use dead bait, as then they hardly ever consider a spoon.

The best tactics are to let out a very long line, and to have one's boat rowed round the shoal, without approaching it too closely. Then, at the opportune moment, draw the bait through by rapid reeling in. To approach closely or to take the boat through the shoal would be quite fatal to one's purpose.

Casting. If the fisherman, possessing a good stout casting rod and reel, can rig it up in time, the sight of surmai smashing up bangra provides the most glorious sport. Cast across the shoal with a long cast and pull through. Repeat if nothing has happened.

A good caster will be able to enjoy incomparable sport with surmai or dagoli, when they are in action in numbers.

An experienced caster, provided with stout tackle, also may enjoy very good fun in casting for bahmin towards the rocks from his boat, but he will lose many fish and some tackle too. The fish are so swift in effecting a snag.

It is because of these tactics of the bahmin that casting from rocks is practically useless, unless the fish is yanked out at once by main force. This no true fisherman would think of doing.

A few word about drift-lining and bottom-fishing follow.

Drift-lining answers best at sunset and after, in places with a good deal of tidal current, such as channels between islands.

According to what one intends catching, light or heavy lines are used, the quantity of lead weight used depends on the force of the current. The baited line is flung out across the direction of the current. More and more line is paid out and subsequently retrieved, to cover as much water as possible. A trace is as often as not dispensed with. When there is little current a float may be used.

Generally rod and reel are dispensed with and hand-lining resorted to, which is enjoyable for a change. It gives one a 'feel' of what is going on, which one never gets with rod and reel.

For bait, prawns' tails or crab are excellent for small fish, and chunks of bangra or large strips out of the side of a fish will do for the larger ones. Small squids are excellent bait.

A variety of this sport, which I would call *surf-lining*, may be successfully practised at many points along the Karwar head. It can be done wherever a small rocky bay or mere indentation in the rockwall shows a lively bit of turmoil and surf, which does not allow an unweighted line to sink to the bottom.

The boat is anchored about 10 yards outside and the baited line flung in. The motion of the water with its currents and counter current causes one's bait to search out the whole place. Quite often very good fishing results, unless the inopportune arrival of the abominable *Trichiurus* puts a stop to the proceedings, or 'phosphors' show up one's line too prominently.

When drift-lining for *Hemihamprus* a fairly large corkfloat is used, to which several short lengths of line, provided with hooks are attached. The device is baited with prawn and flung out, attached to a thin line, which is paid out as required. When the *Hemirampi* are really on the feed, the fun is fast and furious, as frequently 2-3 fish will be hauled in at one cast.

When hauling in a skate or ray, care should be taken that the spines are chopped off before the fish is taken inboard. They are highly dangerous. On a starlit night this form of fishing is quite enjoyable and provides a nice change.

Bottom-fishing is the method mostly resorted to by local sportsmen when they are not netting. It is at times quite interesting and like driftlining it is most productive of results after dark. Groundbaiting with chopped up fish is a necessary preliminary.

If there is no current, the fish bait may be simply thrown in. Wherever there is a current it is advisable to confine the bait in the meshes of an old bit of net and to lower this with the help of a stone by means of a rope. The depth is then plumbed and one's lines lowered to a length, which keeps the baited hook about 2 ft. from the bottom. This precaution avoids a good deal of snagging and loss of tackle.

When baiting with loose chopped fish, or 'chumming' as the Americans call it, a handful of bait should be dropped in every ten minutes or so. This is quite often also done in drift-lining.

Bottom-fishing may at times result in quite amazing catches. I shall always remember an occasion when my wife hauled up in some 2 hours, 50 Red Rock Perch. Most of those in process of being hauled up were shepherded by 2 or 3 'unattached' friends, and it was a truly amazing sight. She might have caught another fifty quite easily as they seemed inexhaustible.

Quite large gobra are frequently caught when bottom-fishing and the kadori, (*Lutianus argentimaculatus*) at the end of a hand-line, provides quite exciting sport, if of decent size. It is advisable to wear gloves when indulging in this pastime to save one's hands from being cut by the line.

The boatmen are quite conversant from personal experience with the best spots for bottom-fishing and surf-lining, and are generally only too pleased to take a hand in the sport, and to help increasing the bag.

As to the most favourable time of the day for fishing in the bay, this is a question often debated amongst visitors.

Personally, I believe that it has in general little to do with one's chances, as these depend on the presence of fish, and that again, as explained before, is a matter of the state of the tide, and of the presence of food fish.

I must, however, admit that I have more than once been lucky with good *Caranx* at Burkia rock at the crack of dawn, seemingly irrespective of the state of the tide.

TACKLE.

It is a home truth equally valid for the expert freshwater fisherman as for the sea angler, that the possession and handling of really first class tackle is a joy in itself, and that such fine tools go a long way to ensure enjoyment and successful fishing.

Such things are however expensive and really not worth investing in when it is a case of just augmenting a casual holiday by the seaside with a little indulgence in sea fishing.

This happens to be very frequently the case with visitors to Karwar, who often have no previous fishing experience at all.

In a few notes placed years ago at the disposal of the Army and Navy Stores for their catalogue, I recommended for the use of such casual and inexperienced visitors simple yet seemingly excessively strong tackle. However extreme these recommendations may appear to the expert fisherman, they have fulfilled their purpose for many a novice, whom they helped in getting a first experience in seafishing, without the disappointment of losing nearly every fish hooked.

However, as these present lines are addressed more to the man with some experience of fishing in fresh or salt water, I shape my recommendations as follows:—

There is scope in Karwar fishing for medium and for fairly light sea tackle. This, in the hands of a practised fisherman, should suffice to deal with anything he will come across, except a giant gobra or a shark, if he has the misfortune to be taken on by any of these. These possibilities, though undoubtedly present, are sufficiently remote to be left out of consideration.

It will have been seen that much of the local fishing is of a very specialized nature, owing to conditions of fairly shallow water and bouldery bottom, which necessitates holding tactics not needed elsewhere in the pursuit of the same fish. These circumstances impel the use of stronger tackle than would be required if the weight of the fish was the only criterion.

To these considerations full attention has been paid, and they should be accepted and considered in this light.

As the result of many seasons' experience I have no hesitation in recommending the following:—

Trolling outfit for casual visitors.—A fairly whippy 7 ft. sea rod after the style of Manton's 'Blair' Sea Rod. A simple reel, such as a 5-inch or a 6-inch wooden Nottingham reel brakeable by gloved hand, or by a lever arrangement. Traces, lines, lures and gaff as for the expert.

Trolling outfit for the expert.—If cheapness is essential, the above recommendation may be considered. If this is not essential then I would recommend one of those very delightful split cane rods such as Hardy's Saltwater Rod No. 2, or an equivalent in greenheart. Such a rod should have a maximum length of 6-7 ft. and should be relatively whippy.

The above-mentioned style of rod is built after the American idea of a short butt and a long one-piece tip. The latter item, ensuring a beautiful whippy action, is very pleasant in use.

The total weight of such a rod is not more than 21 oz. for the tip, 14 oz. for the butt and it is consequently delightful to handle.

These rods are constructed for use either with the old style reel set under the rod, or with the American reel used over the rod.

For a reel to be used under the rod, I unhesitatingly suggest one after the style of Hardy's sea silex, i.e. a reel provided with one or two good checks and brake lever operating by friction pad on the axle. It should be made of non-corrosive metal.

The Army and Navy Stores used to have a very serviceable reel made of walnut and brass and furnished with a very good lever brake.

These reels are easily operated and, so to say, foolproof provided one refrains from jamming down the lever too hard. Sea reels used under the rod, without a lever brake, but provided with the star brake, as in use with big game reels, are also on the market. They are excellent, but demand a little more experience, as the judicious handling of the star brake during the excitement of a good fight demands some practice.

The American style of reel, fished over the rod, such as Pflueger's Capitol reel, is a delightful tool, once it has been thoroughly mastered and every manipulation has become quite mechanical and automatic.

These reels are alike to the well known lever-winding casting reels, but omit the level winding device. By a simple manipulation all tension on the line may be instantly removed and the line made to run free. Further there is a check and a star brake and there is scope for braking directly on the line by thumb and pad.

For fishing in the open I generally set the star brake at just sufficient tension to prevent overruns, and in case of a strike operate it as required, or do everything by thumbing.

When fishing for bahmin near rocks I set the brake harder in order to parry snagging tactics, and supplement this by thumbing as the occasion may require.

The Capitol No. 7989 is just the right size for Karwar. It has the advantage of also being a first class surf and sea casting reel.

The expert, intending to circumvent feeding surmai by bait-casting methods, must possess a good double handed casting rod in addition to his trolling outfit.

There is not much really suitable material for this purpose on the market in this country and such rods have to be either ordered or homemade.

I own an excellent and very cheap homemade one, composed of a 28-inch butt and a 6½-feet tip, the latter being ringal cane. I am quite aware that a split cane or greenheart tip would be superior, but such things are not to be had in these days.

These long single-piece tips have a most wonderful action and are a joy to use.

The fisherman possessed of a one-handed bait casting outfit may find occasional use for it with the wolf herring or small *Caranx*, as well as in the rivers of the vicinity, some of which, as the one running for a distance along the road to Belgaum, hold mahseer, wallagoo, murrel and olive carp in numbers.

Lines.—Nothing but the very best flax lines will do in serious sea fishing. Sea water coupled with hot sun is very hard on a line anyhow. For trolling I recommend nothing less than 150 to 200 yards, as the end of the line gets inevitably frayed on rocks and has to be cut back a bit from time to time, i.e. the line must be frequently inspected even during a day's fishing.

An expert will do well with 18 strand cuttyhunk at bahmin fishing and work near rocks in general.

For work in open water he will probably prefer to use lighter lines such as 15 strand cuttyhunk or even 12 strand.

These lines are permitted by the rules of reputable fishing clubs in most parts of the world, and are strong enough to deal with fish such as those met with at Karwar, provided always that the water is not snaggy.

Beginners, or casual visitors without much experience, would be well advised to use stronger lines, to avoid loss of tackle and loss of most of their good fish.

The 'locals' use nothing below 100 lbs. B.S. so as to be prepared for 'all comers'!

It is advisible to double one's line at the working end over a length of 2-3 yards.

For drift-lining and bottom-fishing expensive lines are generally not used, at least not new ones. Those used already for one season or two will do, or cheap bazar lines.

Traces.—Sea water corrodes ordinary steel disastrously. It is therefore recommended to use stainless steel wire of up to 50 lbs. B.S. This was on the market in rolls of 50 or 100 yards at quite reasonable price, and could be made into the usual 5-6 ft.

traces quite easily, with a box swivel at one end and some kind of an attachment swivel at the other.

These two swivels are ample.

In putting on swivels care should be taken not to twist the end of the wire round the length. Both parts of the wire should be twisted equally, for the first three twists. Then finish in the ordinary way.

Gut is not to be recommended, except for small fishing. My experience with gimp traces was also not very encouraging. If no stainless steel is available even brass wire will do. It will have to be rather thick and is an eyesore to most fishermen, but the fish do not seem to mind it at all.

The use of attachment swivels is often criticized very adversely. However, they are very convenient for a rapid change of lure, and quite honestly, I have never yet lost a fish on account of the swivel pulling out. It is probably just the difference between using only first class stuff and looking at the price too closely.

Lures.—Traditionally, the most successful all-round lure is an oval shaped copper and silver or gold and silver 3-inch super mahseer spoon. It should be armed with a very stout single and a very large treble as a tail hook. Thus weighted the spoon will just produce the very display, so attractive to the fish.

The same spoon in the 2½-inch size serves well when fish run smallish.

Many other spoons have been tried, of all colours and shapes and sizes, but none has ever even remotely equalled the above in all-round steady success.

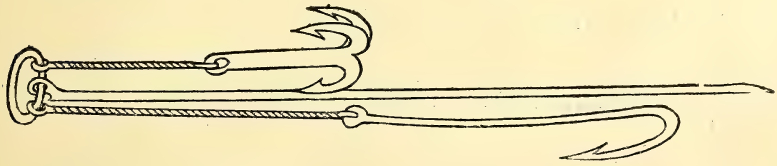
It must however be admitted that surmai take a 4-6 inch all-silver wobbler very well.

A flying mount produces more rapid motion in the spoon, but this is not appreciated by the fish.

I have used a 3½-inch spoon of the super mahseer pattern. It was quite frequently taken, but less so than the 3-inch size.

The pretty Japanese feather-squid so deadly behind a motor boat, is useless at Karwar, as the canoes are too slow.

Plugs of 3½ inch to 6 inch are readily taken. However, these beautiful but very expensive lures suffer terribly from the jaws of these strong fish and are seldom in use.



For dead bait, a very simple device is easily rigged up by means of a brass ring, a single and a treble hook and some wire. A spike for impaling the bait may be added. (See figure.)

Beware of too much spin and stitch up the fish's mouth!

Gaff.—A good gaff with a 3½ ft. haft is essential. A priest or knife for killing one's fish should be carried. A good fishing belt is a great convenience. A sandwich box and large thermos will be appreciated.

A good topi and spine pad are strongly recommended.

Wash your lines in fresh water after every day out, and dry in the shade. Clean your swivels and spoons in the same manner and grease them until in use again.

Be generous to your crew in the disposal of fish. It pays.

If these unpretentious notes should prove useful to visitors to one of the loveliest spots on the coast, they will have fulfilled their purpose.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART XIII.

(*Continued from* p. 425, *Vol.* xliv.)

RHOPALOCERA

PAPILIONIDAE

Chilasa clytia L., *clytia*

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 393. 1938.
Sevastopulo, *Journ. Bomb. Nat. Hist, Soc.*, xliv, 78. 1943.

Ovum—Spherical, the base flattened. Orange, the surface covered with a waxy secretion. Laid singly on the upper or lower surface of a leaf of the food-plant.

1st instar—Head black. Body at first blackish with an olive-brown dorsal patch on the thoracic somites, a whitish dorsal patch on the middle and on the posterior portion of the body. Towards the end of the instar the black changes to an olive fulvous. Under a lens there is a subdorsal series of warts bearing black bristles, the 2nd, 3rd, 4th and 12th somites with an additional lateral series.

2nd instar—Head black and shining. Body black with a fulvous dorsal stripe interrupted by a white V-shaped mark on the 5th to 7th somites and a white blotch on the 11th and 12th somites. 1st somite with a large fulvous subdorsal tubercle, the other somites with tubercles as in previous instar. Osmeterium purple brown.

3rd instar—Similar. Traces of a fulvous lateral band from 1st to 4th somite. Body very shiny as it varnished.

4th (penultimate) instar—Similar. A lateral series of white spots on the 7th to 9th somites and a sublateral series on the 4th to 11th. A small white spot at the base of the subdorsal tubercles. The fulvous lateral band replaced by a creamy stripe joining the dorsal stripe on the 6th somite.

Described from larvae bred from ova found in Calcutta in March 1943.

Papilio demoleus L., *demoleus.*

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xli, 311. 1939.

Immature larva—Head dark brown, the clypeus filled in with pale buff and with pale buff streaks on the cheeks. Ground colour of body dark coffee brown, a broad brown-spotted white lateral stripe on the thoracic somites, a creamy V-shaped mark with the apex on the dorsum of the 8th somite and the arms extending to the lateral area of the 5th, and an indistinct creamy lateral stripe on the 10th and 11th somites. Traces of a white sublateral line. 1st somite with a large chestnut subdorsal spine with a smaller spine just inside it and with a minute white lateral spine. 2nd and 3rd somites with a transverse series of six small dark brown spines, the centre pair the smallest. 4th and 5th somites with a dorsal pair only. 6th and 7th somites unspined. 8th to 12th each with a dorsal pair increasing in size from front to rear. Venter and prolegs olive brown. Legs blackish. Osmeterium brownish purple.

In the very early instars the whitish lateral markings are absent.

Described from larvae found in Calcutta in March 1943.

DANAIDAE

Euploea core Cr., *core.*

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl. 397. 1938.

Ovum—Upright, fairly stout, the top a blunt point. Colour pale creamy yellow. Sculpturing consisting of numerous longitudinal ribs from apex to base crossed by transverse ribs, giving the impression of minute depressions separated by a network of raised lines. Laid singly on the upper or under surface of a leaf of the food-plant

1st instar—Head black. Body pale yellow when first, hatched, becoming a deeper yellow tinged with green after feeding. The filaments of the later instars shewing as minute warts but not differentiated from the rest of the body in colour. Hairless. Legs black.

2nd instar—Head black. Body deep amber, tinged with green after feeding, and with traces of white transverse lines across the dorsum under a lens. Legs, prolegs and anal plate black. Filaments very short and black.

3rd instar—Head black with two white lines as in the adult. Body deep amber, tinged with green after feeding, and with indistinct white transverse lines dorsally. Legs, prolegs and anal plate black. Filaments actually and relatively longer than in the previous instar.

4th (penultimate) instar—Similar to final.

Described from larvae bred from ova found in Calcutta in March 1943.

Danaus limniace Cr., *mutina* Fruhs.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 396. 1938.

Ovum—Upright type, rather dumpy. White, with numerous longitudinal ribs from base to just short of the micropyle, connected by transverse ridges. Laid singly, usually on the underside of a leaf of the food-plant.

Young larva—Very pale grey-blue ringed with black. The filaments develop gradually with each instar.

Full grown larva—Among a number of larvae bred from ova, a fair proportion had the sublateral yellow band entirely obliterated by the broadening of the usual black line above it, in others the yellow band persisted as a broken line in the middle of a broad black stripe. In all cases bred examples were considerably darker than wild, the transverse lines broader and the ground colour more blue-grey.

Out of some hundred pupae obtained in the course of an experiment with differently coloured pupating sites, four were a dull amethyst colour at first and gradually changed to a pronounced blue-green instead of the usual jade-green.

Described from larvae bred in Calcutta in February 1943.

Danaus chrysippus L.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 396. 1938.

Ovum—Upright, ending in a blunt point, with numerous ribs running from micropyle to base. Colour creamy white. Laid singly on the underside of leaves of the food-plant.

1st instar—Head black. Body greenish yellow, the filaments indicated by minute yellow warts. Clothed with short black hairs only visible under a lens. 1st somite with paired black dorsal spots.

Subsequent instars similar to the final except that the long filaments are proportionately smaller.

Larvae reared from ova in captivity are usually considerably darker than wild caught larvae. The transverse black lines are broader, those bounding the yellow dorsal spots often coalescing so that the spots are enclosed in a black band, and the black markings of the prolegs and venter are considerably extended.

The first and second instar larvae have the curious habit of eating a ring in the leaf, usually not quite through, and resting on the uneaten portion in the centre.

Described from larvae bred in Calcutta in March 1943.

SATYRIDAE

Mycalesis perseus F., *typhlus* Fruhs.

Ovum—Yellow green, spherical with the base flattened. Unsculptured. Laid singly on blades of grass. Laid 28-iii-43. Hatched 31-iii-43.

1st instar—Head black, terminating in two small knobs, clothed sparsely with fairly long hairs, white on the face, black on the knobs. Body white, turning green after feeding, and clothed with short colourless hairs. Moulted 3-iv-43.

2nd instar—Head black, clothed with short white bristles and terminating in two pointed processes. Body green, shagreened, with white points along the secondary rings. A dark dorsal line. Anal processes noticeable. Moulted 5-iv-43.

3rd instar—Similar. The head marked with green behind and with a green patch below the vertex, two lines of white spines laterally below the large processes. Anal processes pink. Moulted 7-iv-43.

4th intar—Head chestnut, the clypeus filled in with yellow and with a broad yellow lateral stripe which is continued across the face in a curve just below the cephalic processes. Processes brown in front, the apex darker, yellow behind with a chestnut line from base to the hind margin of the head. Head generally tuberculate and pubescent. Body similar to previous instar. Moulted 9-iv-43.

Final instar—Similar to preceding. The chestnut portions of the head a darker brown. Body with a paler green lateral stripe and a pale subspiracular line. Legs and prolegs green. Spiracles white ringed with brown. A number of larvae had the head in the last two instars dark nigger brown, and a few had a pinkish latero-ventral stripe in the last instar. Pupated 14-iv-43.

Pupa suspended by the cremaster from a pad of white silk. Head straight in front, thorax slightly keeled, wing cases with a distinct ridge above. Colour blue green, a slightly darker line dorsally on the abdomen, and a minute black speck half way along the antenna sheath. A fair proportion have a series of subdorsal white dots on the abdomen. A male emerged 20-iv-43.

Described from material bred from ova deposited by a Calcutta caught female.

Ypthima hubneri Kirby, *hubneri*

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xlii, 39. 1940.

A batch of larva bred in Calcutta in February 1943 produced several pupae of the brown form. The description is as follows. Ground colour dull purple brown, strongly tinged with either grey or olive. Thorax darker than the abdomen and with a blackish line along the keel. Abdomen with traces of a white subdorsal line. Four waved transverse lines edged behind with white, the first short and just anterior to the end of the wing cases, the second extending between the ends of the wing cases, the third again shorter and just posterior to the wing cases, the fourth still shorter and still further back. Wing cases grey or olive, streaked and mottled with darker grey, and with a submarginal series of black specks.

HETEROCERA

ARCTIIDAE

Utetheisa pulchelloides Hamps, *vaga* Jord.

Ovum—Pale yellow, unsculptured, spherical with the base slightly flattened. Laid in small and irregular batches. Hatched on fourth day.

Larva—Head orange with an inverted white V. Body cream with a black subdorsal stripe, the inner portion of which is streaked and spotted with cream. Abdominal somites with a transverse black dorsal bar. Lateral area streaked and spotted with black, the black marks roughly forming a series of Vs with the apices pointing forward. Each somite with four dorsal black warts, the anterior pair closer together than the posterior, bearing short single black hairs, those on the thoracic somites with longer white hairs. A subdorsal series of black warts ringed with dull orange bearing white hairs, and a very small lateral and sublateral series also with white hairs. Venter and prolegs cream, the latter marked externally with black, and with a black stripe, streaked and spotted with cream, dividing the ventral and lateral areas. Legs whitish, ringed with black.

Pupa in a very slight cocoon of white silk spun among litter. Pale chestnut, the thorax blackish except for a central stripe, wing-cases veined with black, abdominal somites each with a black ring. Leg and antenna sheaths striped with black. The amount of black varies considerably both in width and in depth of colour. Cremaster with a row of very fine, slightly hooked, longish spines.

Food-plant—*Heliotropium indicum*. Unlike *U. lotrix*, newly hatched larvae refused to feed on Dahlia.

Described from a full-fed larva found in Calcutta 17-iv-42, pupated 19-vi-42, and a female emerged 24-iv-42.

LYMANTRIDAE

Lymantria nigra Moore.

Sevastopolo, *Journ. Bomb. Nat. Hist. Soc.*, xliv, 417. 1944.

Ovum—Greyish purple, almost round, flattened above and below. Unsculptured (under a hand lens). Some thirty-six hours after being laid, the micropyle becomes slightly sunken and surrounded by a chalky grey ring. Laid in small batches, often heaped on top of each other, in nature probably in chinks of bark. Laid 24-ii-43. Hatched 6-iii-43.

1st instar—Head pale honey brown. Body brownish grey with a paler dorsal mark on the thoracic somites and another on somites 7 to 9. A lateral fringe of pale greyish hair.

2nd instar—Head greyish black. Body greyish black with a pale diamond-shaped blotch on the 7th to 9th somite. A subdorsal tubercle on the 1st somite. A lateral series of tufts of greyish hair.

3rd instar—Similar.

4th instar—Similar. 4th somite with an oblique subdorsal cream streak. 2nd and 3rd somites with traces of the dark transverse slit.

5th instar—Similar to final.

6th (penultimate) instar—Similar to final.

The larvae grow at very irregular rates, some spinning whilst others are only half grown.

Described from larvae bred from ova laid by a Calcutta caught female.

SPHINGIDAE

Cephonodes hylas L., *hylas*.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xli, 315. 1939.
Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xlii, 43. 1940.

A 4th instar larva found with a number of normal green ones, had the head pink tinged with green, the body pinkish. 1st somite and anal flap with yellow tubercles. A faint whitish subdorsal line with a white-ringed black dot below it on somites 2 to 10. Traces of a darker dorsal stripe from head to base of horn. Legs brown. Prolegs and venter pinkish. Horn black, the under surface brown. Spiracles typical.

Full-grown larva—Head brown. Ground colour of body dull pinkish purple, the secondary segmental divisions black. 1st somite black, the first two rows of tubercles yellow, the rest white. Very faint traces of a pale subdorsal line, the spots below on somites 2 to 10 black ringed with white. Anal flap and claspers brown with white tubercles. Horn black, an orange brown basal spot on each side. Legs chestnut, the basal segment black. Prolegs buff, the feet pinkish. Abdominal somites with a broad pinkish ventral stripe. Spiracles typical.

Described from a larva found in Calcutta in November 1942.

Deilephila nerii L.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 407. 1938.
Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xliii, 412. 1942.

A penultimate instar larva found in Calcutta in December 1942 had the head and body pale cafe-au-lait colour, the area above the lateral stripe very slightly tinged with olive, that below with pinkish. Lateral line yellow, edged below indistinctly with mauve. Ocellus white with a dark blue ring as usual. Horn as usual Legs salmon pink. Venter and prolegs cafe-au-lait. Spiracles black. The head with the labrum greenish yellow.

This larva unfortunately died before moulting into the final instar.

LIMACODIDAE

Thosea tripartita Moore.

Forsayeth, *Trans. Ent. Soc.*, 376. 1884.
Hamps, *Fauna Brit. Ind.*, Moths, i, 378. 1892.
Hering, *Seitz Indo-Austr. Bombyces*, x, 713. 1932.

Head green, marked with brown above the mouth parts, retractile. 1st somite green, retractile. Colour yellowish green, the dorsal area between the subdorsal series of scoli bright canary or greenish yellow. The first form with a double purple-red dorsal line expanding into spots on the 4th, 7th and 10th somites, the second form with the lines greenish blue but the spots on the 4th, 7th and 10th somites purple-red. A paired dorsal series of glandular looking marks, consisting of a dull bluish speck surrounded by a dull yellow ring, the whole edged by a dull bluish line, but barely visible without a lens. A subdorsal series of ten short reddish scoli tufted with green or orange bristles, and a sublateral series of ten longer green scoli tufted with green or pinkish bristles and pointing outwards, the first scolus of each series very much shorter than the others. A series of irregular depressed marks edged by a yellow line between the two series of scoli. Ventral surface pale green. Turns pink before pupation.

Cocoon of the usual hard Limacodid type, oval, dark brown in colour. Empty pupa skin brownish yellow.

Food-plant—*Zizyphus jujuba*.

Described from a full-grown larva found in Calcutta 15-x-42, spun 19-x-42 and a female emerged 3-iv-43.

Hampson and Seitz both give similar descriptions, the latter being 'Larva green, with dorsal and lateral rows of blue spots and spined appendages. On Ricinus and other plants.'

Altha melanopsis Strand.

Head pale brown, retractile; 1st somite pale brown, retractile. Body pale bluish green, somewhat frosted in appearance, with a dorsal, two subdorsal and two lateral rows of pale yellow specks, the specks of the inner subdorsal row alternating with those of the outer and the dorsal row. A slightly paler stripe bounded by the subdorsal rows of specks. Venter yellowish green. Shape oval and highly convex.

Cocoon of the usual hard Limcodid type, oval in shape and chalky white in colour, where the cocoon is attached to the support the colour is dull brown. Spun among leaves and concealed under a slight web of white 'frothy' silk. Empty pupa skin brownish yellow.

Food-plant—Tea.

Described from full-fed larvae and cocoons received from Tukdah, Ghoom P.O., in November 1942, and from which imagines emerged in Calcutta in January 1943.

NOCTUIDAE

Sideridis (*Borolia*) *venalba* Moore.

Ovum—Spherical, the base flattened. Very pale green with opalescent reflections and very minutely sculptured, this sculpturing barely visible under a hand lens. The ova turn deep straw yellow and finally leaden grey immediately before hatching. As seems usual in the genus, they shrivel considerably. Laid in batches in the axils of blades of grass and covered with a coating of gummy cement. Laid 16-i-43. Hatched 24-i-43.

1st instar—Head honey colour. Body dull leaden grey. Clothed with sparse, short hairs. Becomes green after feeding. Moves with a slight looping motion.

2nd instar—Head honey colour. Body grey, turning green after feeding, with a whitish dorsal, subdorsal and lateral line.

3rd instar—Head honey colour. Body greyish green with a broad double purple-brown dorsal line, a narrow double purple-brown subdorsal line and a broad purple-brown sublateral line, below which is a very fine line. The area between the dorsal and subdorsal lines darker than the rest of the body. Sublateral and ventral area whitish.

4th instar—Head honey colour. Ground colour of body pale brown, more or less tinged with green. Marked as follows:—a pale dorsal line edged with purple-brown, a purple-brown subdorsal line, a narrow purple-brown spiracular stripe with a paler purple-brown line above and separated from it by a pale line, and a narrow pale subspiracular stripe with a greenish line down the middle.

Sublateral and ventral areas greenish. Legs honey colour. Prolegs greenish.

5th instar—Head honey colour, a faint dark stripe from the vertex along the clypeus. Ground colour of body pale creamy yellow, obscured to a great extent by the minute specks composing the markings. A pale dorsal line, edged by a dark brown line, and followed, in this order, by a pale purple-brown line, a line of the ground colour, a purple-brown line, a line of the ground colour, a narrow brownish-orange stripe edged on each side by a dark purple-brown line, a line of the ground colour, a narrow blackish-brown stripe with a central orange-brown line, and a broad whitish stripe with a central olive-brown line. Venter pale olive-brown, legs and prolegs very pale olive-brown. When contracted, the intersegmental folds orange.

Final instar—Similar to preceding, except that the head bears a lateral dark stripe, in continuation of the dark lateral stripe of the body, and the area between this and the central stripe is reticulated with darker. Spiracles ringed with purple-brown.

Pupa in a small subterranean cocoon of thin white silk covered with earth. Rather long and slender, fairly dark mahogany colour becoming paler ventrally on the abdomen. The anterior margin of the 4th, 5th, 6th and 7th abdominal somites with a transverse dentate dorsal ridge, the teeth rather darker in colour than the rest of the dorsum. Cremaster two fairly long, downcurved, stout spines, with a shorter spine slightly behind and outside on each side.

Food-plant—Grasses.

Described from larvae bred from ova laid by a Calcutta caught female, one of which buried itself 18-ii-43 and a male emerged 28.ii.43.

Sideridis yu Guen. (*exempta* Wlk.)

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xliv, 422. 1944.

Ovum—Almost spherical, flattened slightly at base, unsculptured under a hand lens. At first very pale green, almost white, turning a dull purple grey before hatching. Laid in a blade of grass folded longitudinally by the female and held together by a glassy cement. As usual in this genus, the ova shrivel considerably. Laid 26-ii-43. Hatched 3-iii-43.

1st instar—Head honey colour. Body pale greyish white, almost transparent, when first hatched, turning green after feeding. Hairless.

2nd instar—Head honey colour. Body orange-brown, turning green after feeding, with a whitish dorsal and subdorsal line, a double purple brown lateral line and a broad white sublateral stripe.

3rd instar—Similar.

4th instar—Very similar. Under a hand lens the head has a smoky line from the vertex to outside the mandibles, the sides reticulated with smoky. Body with a whitish dorsal line edged with brownish purple, a purple brown subdorsal line edged with whitish, a double purple brown line, a whitish line, another double purple brown line and a broad white sublateral stripe. Venter, legs and prolegs pale olive brown.

5th instar—Very similar to preceding, but much less green in general appearance and with the sublateral white stripe somewhat duller except on the thoracic somites. Towards the end of the instar, the ground colour is a brownish purple and the longitudinal markings almost disappear.

Final instar—At first a dark olive brown, with traces of a pale dorsal and subdorsal line in addition to the subspiracular stripe and white spots mentioned in the above-quoted description. As the instar advances, the ground colour becomes paler and the traces of the dorsal and subdorsal lines disappear.

Described from larvae bred from ova deposited by a Calcutta caught female.

Prospalta dolorosa Wlk.

Hamps., *Cat. Lep. Phal.*, vii, 324. 1908.
Warren, *Seitz Indo-Austr. Noctuidae*, xi, 345. 1937.

Head greenish grey, speckled with white. Body greenish grey, streaked and mottled. Thoracic somites each with a transverse series of four dark-ringed white specks, abdominal somites with two dorsal pairs, the anterior pair closer together than the posterior. A diffused pale spiracular stripe. 11th somite humped dorsally, with a diffused pale line running over the hump from the spiracular stripe. Lateral area with a series of three dark-ringed white specks arranged in a triangle on each somite. Spiracles brown, ringed with black. Under a lens the ground colour appears to be dark olive brown covered with a net-like pattern of cream lines. Becomes suffused with purple-pink before pupation.

Pupa subterranean in a slight earthen cocoon. Orange brown, the thorax, wing cases and intersegmental rings olive. Cremaster two slightly divergent spines.

Described from a full-fed larva found in Calcutta 14-iii-43, buried 15-iii-43, and a female emerged 25-iii-43.

Both Hampson and Seitz give the same description:—'Larva brown. Food-plant *Conyza balsamifera*'.

GEOMETRIDAE

Agathia laetata F.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 690. 1939.

Ovum—Oval, flattened, the upper surface slightly depressed. Pale green, slightly irridescent. Deposited singly on the edge of young leaves of the food-plant.

Young larva—At first yellowish, later pale green. In the penultimate instar with a whitish ventral stripe on the anterior abdominal somites, and the prolegs mottled externally with brown and whitish.

Adult larva—My above-quoted description is rather lacking in detail and the following is a fuller one. Head brown, marked with darker. 1st somite bilobed, the ends of the lobes brown. Ground colour dark green, varying from an olive to rather a yellow tint, and suffused along the dorsum and across the intersegmental areas with purple, the amount of suffusion varying from almost complete obliteration of the green ground to a slight suffusion on the posterior somites. 2nd and 3rd somites each with a transverse series of four minute dark specks. 4th to 12th somites each with an anterior and posterior pair dorsally. A pair of pale dorsal specks between the 4th-5th, 5th-6th, 6th-7th, 7th-8th, 8th-9th and 9th-10th somites, some examples with an additional subdorsal speck. The 11th and 12th somites each with an indistinct pale V-shaped dorsal mark, which may be almost obsolete. Proleg marked externally with a whitish patch mottled with brown. Legs dark brown. Venter green with a broad white stripe from the base of the third pair of legs to the 6th somite, this stripe containing a double purple line. In some examples the stripe is continued faintly to the 8th somite.

Pupa in a slight web between two leaves, through which numerous small holes are gnawed. Colour pinkish, sparsely speckled with black, with traces of a dull olive dorsal stripe and transverse stripes on the intersegmental areas. 5th to 11th somites each with a pair of small depressed pits on the dorsum anteriorly and the 8th to 10th somites each with a rather larger pit sublaterally, the one on the 9th somite slightly below these on the 8th and 10th, the dorsal series only visible under a lens. Thoracic spiracle placed in a sunken spot. Cremaster spade-shaped and ending in a cluster of hooked spines.

Described from larvae bred from ova found in Calcutta, one of which pupated 26-xi-42, and a male emerged 7-xii-42.

Agathia lycaenaria Koll.

Prout, *Seitz Indo-Austr. Geometridae*, xii, 67. 1932.

I am unable to detect any real difference between the larva of this species and that of *A. laetata* (above), although it is possible that the white ventral stripe is a little longer in *lycaenaria*.

Four apparently identical larvae turned to four, apparently similar, pupae and eventually produced two imagines of each species. On closer examination it was noticed that the lateral pits provide a definite distinction, those of *lycaenaria* are considerably larger and darker in colour, being clearly visible to the naked eye whilst those of *laetata* are barely discernible without a lens. The cremaster of *lycaenaria* has the sides straighter and longer, that of *laetata* being blunter with curved sides.

Food-plant—Oleander (*Nerium odorum* Soland.)

Described from larvae found in Calcutta, one of which pupated 2-xii-42, and a female emerged 13-xii-42.

Seitz gives the following description :—'Some Queensland larvae in the Tring Museum (F. P. Dodd) are of moderate thickness, almost uniformly cylindrical, the head bilobed, the prothorax projecting slightly over it and bearing on each side a small and not very sharp triangular prominence anteriorly; yellow-brown, mottled or streaked with reddish, appearing to the naked eye uniform in colour.'

Thalassodes veraria Guen.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xliii, 415. 1942.

This larva also has a green form, the head and body being green with traces of a dark dorsal line, shewing mainly as a dark purple dot on the intersegmental areas of the abdomen, and with a sublateral dark brownish spot on the intersegmental areas. Legs, prolegs and venter green. Spiracles very small, pale buff. In some examples the points of the head and the dorsum are suffused with reddish chestnut.

The pupa is also variable, in addition to the buff form there is one which is olive green speckled with darker olive and blackish and with a very dark olive dorsal line, the wing cases yellower and unspeckled but with the costal margin suffused with smoky olive. Another form is greenish buff, the thorax smoky, with a blackish dorsal stripe on the abdominal somites and with blackish streaks and specks arranged roughly in transverse lines, the wing cases pale smoky buff.

Food-plant—These green forms were found feeding on Rose.

Described from a full-fed larva found in Calcutta 30-xi-42, pupated 4-xii-42, and a male emerged 13-xii-42.

PYRALIDAE

Galleria mellonella L.

Head dark reddish brown. Body dirty grey, rather paler on the sublateral and ventral areas. 1st somite with a semicircular black-brown dorsal plate, divided down the centre. Head and body with sparse single colourless hairs. Legs pale brown. Prolegs whitish grey.

Pupa in a spindle-shaped cocoon of tough white silk, spun in one of the tunnels in which it has lived. Colour very pale chestnut, becoming darker on the centre of the dorsum, the thorax darkest. A distinct dorsal ridge on thorax and abdomen. Spiracles chestnut. Cremaster a transverse bar ending in two points.

Feeds on wax, etc. in the combs of bees, making silk-lined tunnels in which it lives.

Described from a full-fed larva found in Calcutta 7-ii-43, spun 8-ii-43, and a female emerged 25-ii-43.

(To be continued)

Corringendum

'Vol. xli, p. 76.

The larva described as *Andraca bipunctata* Wek. belongs to *Prismosticta fenestrata* Btlr. This species was first described as a Bombycid but was subsequently transferred to the Eupterotidae. The larva shews that the original describer was correct in his classification. A description of the true larva of *A. bipunctata* will appear in a later part of this paper.

SOME REMINISCENCES OF SPORT IN ASSAM

By

H.G.H.M.

Part I

Shikar and love of the jungle life must be one of the inheritances in my make-up; and my development in this direction, while no doubt subjected to the inner push of hereditary forces, was also much assisted by the environment of my early years. All the days of my boyhood spared from the needs of education were devoted to various forms of sport, and the reading of the travels and adventures of renowned hunters of the past century—Gordon Cumming, Forsyth, Selous, Sanderson, and a number of others. The early years of my army service were passed in the United Provinces and the Punjab where small game shooting, and the pursuit of black buck and chinkara with rifles of small calibre afforded good training for more serious shikar later on.

After some eight years of life in the plains I was fortunate in being transferred to Assam where, except for the years of the Great War, I served for another twenty-five years. During all these days in Assam, a country which has been said to consist of jungles and tea planters, many opportunities of sport were afforded to me, and it is on reminiscences culled from an unusually retentive memory that I will now embark.

Though I had been in Dhubri several times I had not met the Rajah of Goalpara until I was posted to the Goalpara District as Civil Surgeon, but shortly after taking over charge I called on him. Of course I had heard about him as a sportsman and an extraordinary shot, both with rifle and gun, but was surprised to find him a delicate, nervous man of retiring disposition. At the time of this meeting I had shot specimens of most of the big game to be found in Assam, but had never been able to bag a tiger, though I had sat up very many times, both in machans and on the ground, without success. I had always been discovered, and it appeared to me that I was always detected from the direction the men had been working on the machan, and this was usually from the back. I am convinced that a tiger, if at all suspicious, and they have always been so on the numerous occasions I have waited for them, circles 'round the 'kill' to make sure, before approaching it, and my humble opinion is that they get the scent of the men who have made the machan, and having got this scent soon discover the waiting sportsman, for their hearing is so keen that the very slightest noise will be heard and, suspicions aroused, they very soon know exactly where is the hidden danger. The tiger may now go right away, or he may lie concealed in the jungle waiting developments. If the shikari leaves his machan or other concealment after dark the tiger will very frequently partake of his deferred dinner, for he now well knows that the danger is over. If he has not returned to the kill it can be taken as certain that he is away for good and will kill in some other locality.

One often reads of tigers not returning to their kill, and the impression is given that they just did not come back. This is entirely wrong, for a tiger kills to eat, and the reason for the kill not having been touched is nearly always that the owner of it has come back and discovered danger. I have many times heard a tiger late in the evening moving round the machan and gradually making the circles smaller, and am convinced that tigers can detect scent of man and animals. Their sense of smell, though not highly developed as with deer and bison etc., is yet sufficient to enable them to detect the scent of human beings having been near their kill, or being concealed near by. I know that most of the writers on the habits of tigers say they have no sense of smell yet I feel quite sure that they have. If they have none at all how is it that they follow deer when they change their feeding ground? If they do not follow by scent how do they manage? None of the writers give a reason.

A tiger does not hunt altogether by scent; if he did he would never go hungry and no animal would ever escape. He actually hunts by sight as everyone knows, aided very much by his phenomenal sense of hearing. His sense of smell informs him that his food, whatever it may be, is in the particular locality and, knowing this, he uses his sense of hearing and of sight to procure it.

The Rajah of G—, who has taught me almost all I know about tigers and their habits, returning to camp of an evening has said to me, 'of course you know where to find tiger during the day —all streams, the thicker the cover the more does the tiger appreciate it, for it means concealment, coolness, and shade; but do you know where to find the tiger in the late afternoon and evening?' I did not know, and said so. 'Well', said he, 'you will find them often on an open plain behind a bush or tuft of grass which you would say could not conceal a tiger, and it would seem impossible that a tiger should be there. This fact has been demonstrated to me on many occasions. A tiger coming down through thick jungle growing on both sides of a small stream gets the scent of cattle; he remains in the cover during the day; as late afternoon approaches he emerges and comes to the edge of the plain—to survey abandoned or recent cultivation where the cattle are grazing. Hiding behind cover that one would think would not conceal a hare he waits until a cow or calf comes within distance, or he may cautiously shift his ground to be in a better position for the attack. On many occasions I have seen tiger dislodged from bushes you would have said to be impossible for concealment of such a great beast. He will allow elephants to pass him on all sides without moving. To find tiger in these positions every bush or isolated patch of grass should be searched by the beating line. In these cases the shot is usually a long one.'

On one occasion I was out after bear, and while on my way to their haunts some villagers ran up to say that a tiger had just killed a cow near their habitations. This killing had taken place at 10 a.m., in the plains, at the foot of the Garo Hills and not far from the Dalu Inspection bungalow. It seemed that the cow was not dead when the villagers ran up to it, and in their anxiety to get it away they tried to make it rise, and in so doing pulled the body round completely so that the head was facing to the opposite direction. I went up to the small hill on the other side of the road and having selected a position got the people to cut away some of the jungle so that I could get a clear shot towards whichever direction the tiger might approach. I felt certain of a shot, as the well from which women had been drawing water when the kill took place was within 15 paces of the kill. Such is the boldness of the unhunted tiger; and I felt sure the animal would return late in the afternoon, and before dark. At 4 p.m. I heard the noise of an animal coming down the opposite hill and thought it must be a sambur. It came near the kill and I did not hear it move away. While the animal was approaching down the hill, and for a considerable time after, a squirrel on a tree behind me was very noisy. It was not scolding me, but because it had seen the animal. I sat perfectly still, and made no movement, so could not have been detected by sense of hearing. The animal went, and the reason I had not heard the departure was that there was a game path and the two *tigers* had gone away by this! When I, the enemy, was discovered, it is difficult to say; and how and why they discovered me it is difficult to say. The matter remains a mystery. I waited until dark and then returned to the bungalow. It was found next morning that the tigers had not visited the kill proving, to my mind, that I had been detected. But how? It must have been by scent, as my small hillock was on the opposite side of the road from the larger hill down which the tigers approached. The village was fifty yards to my right. I was sitting on the ground in midst of a bush, made no sound, and could not possibly have been seen. Maybe I was not detected and the tigers sheered off because the kill was not in the position they had left it, for it had been turned completely round. But such jungle tigers as these should not have been put off by this. Very little clearing of twigs etc., had been done near the kill. The villagers knew me, and knew that the reward I would give would be divided among them. No: there was no *badmashi* in this instance. Had the kill not been moved would the tigers have fed on it? Perhaps. The moral of the story is that nothing can be left to chance: the kill must not be moved, the sportsman must not move, and the breeze must not be from the wrong direction.

It is within the experience of many sportsmen to be 'seen off the premises' by a tiger. The last time I waited for a tiger was at a shooting and fishing spot—Nechuguard, at the foot of the Naga Hills and the commencement of the Nambur Forest. Late in the afternon I came on a fresh tiger kill and got behind a bush in the hope that stripes would return during daylight; a not unusual occurrence in dense jungle. But I had forgotten the place was 3 or 4 miles away from the road! With me was a Gurkha lad. We left at dusk and were two miles from the road when it became dark. All the time I sensed I was in great danger. I had seen and heard nothing, but yet was in a terrible and uncontrollable fright. On reaching the road I was in a bath of perspiration. Asking the boy if he felt afraid he replied that he had been so frightened that he could not speak. He knew we were being followed nearly the whole way by the tiger, for he described the spot where he first heard the animal, and after that he heard it nearly the whole way. I had heard nothing, but am slightly deaf. The lad had wanted to tell me but could not speak!

I had another curious, and fortunate, experience. Arrived at Kirappara, the second stage on the way to Dalu, Garo Hills, on the Mymensingh border, a place fifty miles from the nearest human habitation, I went for a walk in the afternoon and saw the pug-marks of tiger along the road. With the aid of my cook, a Muhammadan with a liking for shikar and a very courageous man, these were rubbed out. On the way back we found fresh marks, so the tiger was in the habit of using this road between the hours of four and six in the afternoon. I decided to remain a day and try for the animal, so the next afternoon took up position in dense cover and close to the road.

This was in 1919 after return from the 1914-18 war. Kalia (the cook) cut sticks and made a rest for the rifle, using my khaki pillow case to wrap round the wood to prevent barrel-jump. Had the tiger come along I would have had an easy shot. Before going on Service I had sold all my weapons and all I now possessed was a 20 gauge shot gun and a 22 H.V. Savage Magazine Rifle. At about this time I had read a lot about the 22 being ideal for tiger. The writer said that he was with the Prince of Wales' shooting party in Nepal and was using this weapon on that shoot. He must have arrived at his opinion on the weapon from one lucky shot, and without further experience, for I have seen the 22 H.V. used on tiger a number of times and can say it is certainly not a weapon to be used against any of the big cats; not fair to the shooter himself, to his companions, or the game. All this is by-the-way, for the expected tiger did not appear. Next morning the cook went early to recover the pillow-case, which had been forgotten, and returned to tell me to dress quickly and see what had happened in the night. This is what we found. A known rogue elephant of the locality had come along the road, scented the pillow case, gone straight to the spot, removed the rest-bar, stripped off the pillow case by putting his foot on the bar and pulling off the cloth, and then walked back to the road where he left it in the dust. Fortunate for us that we had come away before the elephant came along, for the 20 bore gun and the .22 rifle would have done little damage and caused an already testy temper to be exceedingly violent!

On my taking leave from the Rajah he laughed in his nervous way and said to me, 'You will shoot your first tiger in April. I will invite you to my camp, but the notice will be short, as when tiger are about arrangements for the hunt have to be made very quickly.' Thanking him, I returned to Dhubri which is some six miles from Gauripur.

It was perhaps two weeks later that I received one morning the expected invitation and request to be at the Ferry that afternoon at 3 p.m. My wife accompanying me, we met the Rajah as arranged, and having crossed the wide Brahmapootra river to Fakirganj drove in a dog-cart to the camp which was situated a few miles from South Salmara.

Next day being Good Friday I said I would rather not go shooting, so the Rajah went to a locality where tiger would not be disturbed, to shoot some deer for the camp followers who needed meat. To keep the camp contented in this respect makes the people keen and willing.

While he was away I had been to the South Salmara Dispensary and on the way back was informed by a small boy that a tiger had just killed a cow and dragged it into some jungle. Very excited was the mahout, and also crestfallen when I explained that the pipe I was smoking would not be of much avail! When Gauripur returned to camp in the evening we talked the matter over and it was arranged to start at 10 the next morning.

Having learned that the Rajah expected great punctuality on such occasions we were ready ten minutes before the hour. We were to meet Royalty—The Royal Tiger—so pad elephants had to be in position ten minutes before the hour; guns and guests on the pads by ten sharp; howdahs, spare elephants, and beaters ready at the meeting place when the Rajah and his party arrive.

By 11 a.m. we were on the ground. The plan shows the position of the 'kill' and the lay-out of the beat. Arrived at 'A' the Rajah called up his head shikari and after hearing what he had to say went off, as is his habit, to see things for himself. He followed the 'drag' cautiously, and very slowly, until he found the remains of the cow. Then he returned and came again to A and proceeded to B. almost immediately finding the 'animal run', or game track. This he followed on towards the river, and being satisfied that other 'runs' did not exist in that particular portion of the jungle returned again to A, where I and my wife were in the howdah on back of the mighty Jung Bahadur. Now he said to me, 'If you will permit me to explain I should like to tell you something of the art of driving a tiger in a particular direction'. I assured him I would be only too glad to learn for I knew nothing of the game. While this was going on the elephants were collecting at D—with them one howdah elephant. 'Well', said he 'the first thing to note is that if I attempted to drive the tiger in the direction of the fields he would refuse to go, and would fight. Whenever it is possible the tiger must be brought to the gun without annoying him, and so ensure a quiet and fatal shot. The next point to remember in this particular drive is to drive very slowly and without any noise; just the slow forward advance of the elephants is sufficient: this will keep him from crossing the river. Were he beaten out with a great noise the tiger would be scared and would be certain to rush to the river, jump in, and swim across. A great aid in preventing the tiger going to the river is to keep the line of elephants diagonal, the right end advanced along the river bank with the howdah elephant on the Nulla side in the open as far as possible and some distance in advance of the beating line and in line with the leading elephant. When the tiger hears the elephant on the river bank he will not hear those farthest away, and as the howdah elephant is not in the jungle but walking just outside he will not hear him except when he comes out and sees him, and that will make him go back into the jungle. The beat continuing in this diagonal manner will edge the tiger away from the river and quietly swing him on to the nala side, which is your side, and when the tiger reaches the 'animal run' he will follow it and give you an easy shot. If he attempts to cross the river I will take a long shot.' He then took me to B, and Jung Bahadur was ordered to push down a small tree so that it would fall towards the nala. Then some grass was pulled away until the animal run could be seen entering the lighter jungle just as it quitted the tall grass and heavy cover. 'Now', said Gauripur, 'your tiger will appear there', pointing to the exit of the run, 'I will take post at C. Mark the line of beating elephants coming into position with the aid of your binoculars, and carefully watch the 'hullee', as the shaking of the grass tops is called when the tiger moves from place to place, for that is your sure indication of the whereabouts of the tiger.' Then he signalled to the line to advance and went off to his selected position at C.

Soon came the signal from the line that the tiger had been found in the rose-bush cover. 'See', called the Rajah, 'the tiger is now in the heavy jungle, watch the 'hullee'. Carefully I watched the 'hullee' which followed zig-zag between the nala and the river. Suddenly it ceased and I knew the quarry must be in the animal run. Now my pulse hammered rapidly and my heart thumped, for the Royal beast was at hand and my excitement intense. Slowly I brought the rifle to bear on the expected place. Sure enough, there, where the Rajah said it would, appeared the head, and soon the line of the back was plainly visible. I pressed the trigger and experienced a thrill of delight as I saw the tigress—for it was the 'Queen' and not the 'King' on this occasion, fall over on her side. I had used a .280 double rifle and was still covering the animal when the Rajah came up. The distance from muzzle to animal was not more than 15 yards. Jung Bahadur is a very tall elephant and the tigress was below me and slightly to my left. 'Good shot' said the Rajah, 'but it is always wise to put in a second bullet, for it does not damage the skin as most people think'. But this time I had brought the rifle on to the howdah rail with the muzzle pointing skywards, as is the strict order of the Rajah. The beating elephants were crowded around the place so that I could not with safety deliver a second shot. I said so and the head shikari, who heard my remark, was told by Gauripur to tell the mahouts; and to tell them also that by crowding round in that manner they stood a good chance of a bullet if the person in the howdah became excited. In the evening I was told that I had gained the confidence of the mahouts and that, to a sportsman, spells success. 'Now the mahouts will trust you' he told me, 'and that is half the battle in tiger shooting.'

I handed my rifle to the Rajah and he put in the second shot 'to make sure' saying to the mahouts that I had wished it. The men laughed and said 'quite right, quite right!' but does the Sahib think we would be around like this if we did not *know* the tiger to be dead? yet—Quite right, Quite right!'

My mentor looked at the rifle and then at me. 'Yes, pea-shooters are all right at this range but they are not the weapons to use against tiger. I advised you to always use your .475.' The mahout had absolute confidence in his elephant, for when the tiger was close, and in the animal 'run', I glanced down and saw him fast asleep! He knew that Jung Bahadur is absolutely steady. There was mutual trust between mahout and elephant. Never shall I forget the sight of that head and shoulders appearing in the open: my first view of tiger. She measured 8 ft. 4 in.

It is my experience, though I have read opinions to the contrary, that the proportion of tigers to tigresses shot is 1 to 3; and I think I am right, for I have seen perhaps over 100 tigers killed: besides, the Rajah, who has seen very many hundreds of tigers slain put the ratio same as I do. Recently, in an article in the Journal of the Bombay Natural History Society (Vol. XLI, No. 4), contributed in April 1940 by the curator of the Society, data are published which reveal a great preponderance of males over females, both among animals shot in several Provinces and those enumerated when drinking at water-holes during the hot weather in Bihar. Figures cover the period 1936-39; and the note of Mr. G. H. Marshall regarding the Naga Hills, Assam, shows 59 animals killed during the years 1927 to 1937 of which 27 are males and 32 females. The subject is interesting. The evidence seems to show that males are now definitely more numerous than females; while in my days in Assam, and in other parts of India as I am informed, females used to be, only twenty-five or thirty years ago, markedly more numerous than males. Tigers are rapid breeders, and such a change is not impossible. But the reason for it? That may be difficult to arrive at. Diminution of natural food supply—deer, pig etc., by reason of extending cultivation and the slaughter of wild animals to satisfy the meat hunger of the people: these may be the causes at work; but it is a poor lookout for the continued survival of the species in numbers comparable with the past.

The day was yet young so I urged my host to make it a more perfect one by himself shooting a tiger. 'There is a chance,' he said, 'for we have news of another beast not far away.' The tigress was padded and sent to camp to be skinned. Only female elephants are used for this as only these will allow a tiger to be placed on the pad, and not every female either.

Before long we reached the new locality and I, in my inexperience, would have said it would not hold a tiger. It consisted of two oval patches of thick grass jungle in the midst of cultivation, these being connected by a 'neck' of thinner cover. G. was on an elephant named Mylo, an untried beast, so decided to take post in the open, level with the 'neck' but 100 yards to one side of it.

When the beat commenced it was soon realized that the grass, as is often the case, was deceptively tall, and not only overtopped the backs of the pad elephants but was also thick, and a very possible retreat for a tiger. Towards the end of the beat my mount, Jung Bahadur, whose howdah was occupied by my wife and I suddenly stopped, as he was almost on the top of the crouching tiger, which growled at him and started the adjacent elephants trumpeting and making the well known metallic sound, sure indication of a tiger in the vicinity, by beating the ground with curled-up tips of their trunks. All this indicating that the tiger was likely to try and break back through the line of elephants. The Rajah called out for Jung Bahadur to be at once taken out of the cover, and just as we emerged into the open a shot was heard, and immediately upon that came a shouted instruction from the Rajah for me to go on with my elephant and kill the tiger struggling on its back. This I did, with two shots, as Jung Bahadur was steady as a rock. The Rajah was pleased as a boy would be, although this was about his three hundredth tiger, for the shot had been a long one, something like a hundred and thirty yards. The Princes and Rajahs of India are many of them marvellous shots both with rifle and gun. They have plenty of practice! In days long gone by, an Indigo Planter held the record with 1000 tigers to his own gun. There is at the present time one Ruler in the centre of India who has shot over 600! This animal was a tigress a little larger than the one I had killed earlier in the day. The rifle used by the Rajah was a .465 by Holland and Holland which had been presented to him when he was a boy by the old Maharajah of Kooch Bihar as reward for his already marvellous shooting. His other two favourite weapons were a .577 and a .450, both black powder rifles.

After the tiger had been padded and sent to camp we beat out the cover again as pig had been seen, and I shot one with my .280; killing it dead—a close shot.

That night we had a long talk on shikar and of course the day's sport was discussed in detail. My wife was asked what she thought of tiger shooting. 'It is very interesting and very exciting', she replied, 'but that tigress you brought out to my husband was well trained; was a Viceroy's tiger, blue ribbon round its neck sort of thing'. 'G' laughed and said, 'I hope to show you, if not on this shoot some other time, that all tigers do not wear blue ribbons. If the danger is not too great I will make a tiger demonstrate for your edification.' The next morning it was not long before the quickly descending vultures had picked clean the bones of both the animals dragged into the open for them to demolish. There was the usual fighting, screaming, and scrimmaging, with sometimes that tug-of-war, when two birds have either end of a tasty morsel, which is so amusing to watch and at the same time a somewhat obscene spectacle.

On the Monday morning we went to a place indicated by the scouts but it turned out that the kill was a very old one and the Rajah was proportionately annoyed. 'However', said he 'we may as well beat the place. I will place myself just in front of that path which passes through the jungle. 'The beat was in progress when a villager, walking along behind my elephant (J.B.) spoke to the mahout. 'What are you looking for?' said he. Mahouts do not usually possess a sense of humour, but 'Rats', he replied. The villager did not even laugh but said, 'If you are looking for tiger, there is one standing behind you!' And so there was! The beat was stopped and I was placed in best position for the shot, but the tiger broke back. Three times this occurred. The tiger was able to play this game because we only had out about a dozen beating elephants on this morning. The next beat found the tiger bolting across a long open space in order to gain some extensive, continuous, jungle out of which it would not have been possible to beat him with the few elephants available. 'G' took a long shot and killed the beast, bowling him over like a rabbit. A marvellous exhibition of accuracy and judgment of pace. A fine male tiger.

Not far from this place another tiger was put up in a large patch of grass jungle which was beaten on the chance of it holding something. Here was an opportunity for the Rajah to show how to make a tiger demonstrate. This he did by driving her—for it was a tigress—towards some fields. Naturally she objected, and went up and down the line of elephants growling and jumping up at almost every one of them. As she jumped the elephant would roll up its trunk, screech, and back on its hind legs. Again the shot was to be mine but I was looking to my right when the beast passed close to my left. My wife pointed and called to me but I was too late and the tigress disappeared into thick cover. 'Now' said the Rajah, she will probably charge, and if she does you must get off two shots, for even if you miss this will be likely to baulk her spring at the elephant. Of course she may not charge and perhaps give you an easy shot. Good luck,' and he turned away. When the tigress broke she jumped out with a grunt and instead of charging galloped in and out among the beating elephants just emerging from the cover. It was impossible for me to fire and she got away into the open. 'G' was behind me and to my right. He waited until the beast was well clear, and then killed her stone dead with a shot in the the shoulder which turned her head over heels. The distance was something like two hundred yards. Not many men are there who can bring off shots like that.

We had only just moved off when there was heard a loud 'Proot-proot'. All except my wife and I knew what this portended, and were we to again hear it we would at once be galvanized into action. Right and left all the elephants made off to the cover into which they disappeared like a sounder of immense pigs. Looking behind I saw that a tusker elephant was coming for us and the next moment there was a crash as Sibjee, a large tusker, struck Jung Bahadur in the rump. The impact was terrific. Fortunately J.B. was such an immense brute that Sibjee failed to knock him over, but the shaking we got in the howdah was terribly frightening—words cannot convey what the shock was like; to understand it it has to be experienced. My wife lost her hat, umbrella, etc. The mahout urged J.B. to his best pace and Sibjee accelerated him from the rear by three tremendous pushes. It was all we could do to remain in the howdah.

It has been suggested to me that I should have fired a shot at Sibjee, but that was impossible both on account of the motion and the fact that the mahout was still on Sibjee's neck wielding his ankus with tremendous digs deep into the head and then pulling hard on the heavy iron implement with all his strength. The chase went on for near a mile, and at last Sibjee's mahout got the animal under control by pulling a blanket from under him and putting it over the maddened beast's eyes. The great danger had been lest J.B. should have attempted to turn to meet his assailant. In course of doing that he might have been struck sideways and knocked over, with perhaps fatal results to all three on his back. That this might occur was in the mind of the mahout for J.B. had once been used to catch wild elephants, being sent into the stockade to punish recalcitrant tuskers, a duty which he used to do very thoroughly. That was before he came into the possession of his present owner and when he had belonged to the Rani of Bigni. Had J.B. started on Sibjee he would have made a thorough job of it; and what would have happened to us! Our mahout did the right thing by heavily punishing his elephant in order to get him clear of the assailant as soon as possible.

After a while J.B. calmed down and quietly grazed with the other animals gathered around us. Besides his keddah experience J.B. had at one time been used as a fighting elephant at displays of that kind: he would have given Sibjee a great thrashing. Sibjee had been known as unreliable having killed several mahouts and grass cutters, but this was the first time he had attacked an elephant. Years after this occurrence he attacked a female elephant, upsetting her and killing her mahout, after which he was used only as a provision carrier and kept a mile or so behind all other elephants. The sight of a tiger seemed to upset him. After we went to Bangalore the Rajah most kindly sent us an invitation to another shoot saying, 'I hope Mrs. M. will come. Tell her that Sibjee is dead and she need have no fear of such an occurrence again.' After that first shoot we went to many another but my wife had had too nerve-racking an experience and always remained in camp.

Next morning the shoot was closed down as the mahouts were rather agitated over what had happened, and when in that state of mind would not work well. The elephants swam across the wide Brahmapootra and we returned to Dhubri well pleased with our first experience of tiger shooting and grateful to our kindly host for having afforded us the ever memorable experience. Many have been the shoots I have been at since then, but that first one will always stand out as *the* shoot.

At time of preparing these reminiscences for the Natural History Journal I received with much sorrow the sad news of the death of my friend, the much beloved Rajah of G. He has gone, as he himself said when nearing the end, 'to the Happy Hunting Grounds'. Before he died he read with much pleasure and interest the first two parts of this series and I, holding his memory in affectionate remembrance, am glad that was so.

Since the shoot above described the Head Shikari referred to has also gone to the Happy Hunting Grounds and the elephants Sibjee and Jung Bahadur are also dead. Stories about them will be related in that country for many years to come and the Rajah will always live in the affectionate memory of his people.

(*To be continued*)

NEW SPECIES OF *CEROPEGIA* AND THE SYNONYMY OF THE INDIAN SPECIES.

BY

CHARLES McCANN, F.L.S.

For the past few years I have been studying the Indian species of the genus *Ceropegia*. My studies have been carried out in the field as far as possible, and at the same time I have examined all the herbarium material available in the country. In this connection I must thank the heads of the various institutions who so kindly sent me the material for examination. The work is almost complete, but unfortunately, owing to the present paper shortage it will be a considerable time before I am able to publish the results of my work in full. However, I feel that in spite of all the restrictions at least the descriptions of the new species should be published together with the synonymy as adopted in my revision of the genus. The text and the illustrations of the revision will be published in full at the proper opportunity.

Ceropegia Evansii[1] sp. nov.

[2] *C. Evansii accedit ad C. hirsutam habitu general, sed facile distinguitur flavis corollae lobis atque exterioris coronae lobis breviter bifidis, dentibus obtusis; in C. hirsuta lobi sunt profunde bifidi, dentes acuti. Novae huius speciei folia sunt largiora ac margis cordata quam in C. hirsuta.*

Description.—Roots-system a tuber, 2-5 x 1-3 cm., subglobose, usually depressed; roots fibrous. Stem twining, 3m. or more in length, simple or branched, green or tinged with purple, deep purple, or almost black. Leaves up to 18.5 x 8-10 cm., reducing upwards, the lower ovate or ovate-lanceolate, lanceolate above, membranous, hairy above and along the nerves beneath, ultimately glabrous or nearly so, margins shortly ciliate, dark-green above, paler beneath, base rounded or subcordate, with a few (2-6) glands near the insertion of the petiole, apex acute or acuminate, petiole up to 40 mm. or slightly more, stoutish, channelled above. Flowers small or large (varying much in accordance with the vigor of the individual) arranged in umbellate cymes; peduncle 1-5 cm. long dark purple, hirsute with stiff bristles; pedicels 1-2 cm. long, green; calyx divided to the base, 6 mm. or slightly more, glabrous, segments linear or subulate; bracts subulate; corolla up to 37 mm., base inflated, globose, slightly constricted above to form the funnel-shaped tube beneath the lobes; the united corolla lobes form a subglobose or oblong head about 1/3 the length of the entire flower; lobes broadly ovate or ovate-oblong (when opened flat), softly puberulous within, margins ciliate, the upper 2/3 of the lobes lemon yellow passing into white below, the tube greenish white often with a faint pinkish tinge, internally the lower half of the corolla tube is tinged purple; corona, outer lobes 2-fid, the denticulations obtuse, margins ciliate with a few hairs, inner lobes subulate or subclavate, yellow tinged with pink. Follicles up to 12.5 cm. at first erect, then divaricate.

Locality.—Khandala, Western Ghats, 1,800 ft., Bombay Presidency, McCann 4647; (*Type* Herb. McCann); Santapau & McCann 5059, A.B.C&D.; McCann 4644, A&B. to 4646 & 4648 to 4650; 4801 (*Co-types* Herb. McCann); Santapau

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[1] Named in honour of the late Mr. F. V. Evans of Liverpool who helped me much for many years in carrying on my research work.

[2] My thanks are due to Rev. Fr. H. Santapau, S.J., for the Latin descriptions.

& McCann 137, 21, A.B.C. !; Santapau 910A !, 920B !, 921C !, 992D !, 2261, 2212 (*Co-types* in Blatter Herb. St. Xavier's College, Bombay).

Note.—This is undoubtedly the plant referred to by Graham in his *Catalogue,* p. 117, but not given a name. It is one of the commonest species occurring at Khandala.

Ceropegia Farrokhii[1] sp. nov.

C. Farrokhii accedit ad C. kachinensem Prain, generali habitu, sed facile separatur ab hac specie lobis exterioris coronae integris; in C. kachinensi exterioris coronae lobi sunt bifidi.

Description.—Root-system not seen. Stem simple or branched, twining, somewhat slender, hairy. Leaves 1.5-8 x 0.5-1.75 cm., narrowly lanceolate, acuminate or acute, base cuneate; petiole 12-15 mm. Flowers 2-6 together on a short hirsute peduncle, peduncle 1.5-2 cm.; pedicels shorter than or as long as the peduncle, hirsute; calyx divided to the base, segments linear-lanceolate with a few hairs on the dorsal surface; corolla 15-18 mm., base inflated; lobes 6 mm., hairy along the margins, outer coronal lobes entire, almost ¾ the length of the inner coronal lobes, ciliate, inner lobes spathulate, approximate. Follicles not seen.

Locality.—Kachin Hills, Burma. Shaik Mokim (Dr. Prain's collector) obtained the tuber on 16-10-1897 which flowered at Calcutta in November 1902. Herb. Royal Bot. Gardens, Calcutta, 2. sheets; *Type* specimen, the sheet with the branching specimen.

Note.—Specimens of this species were placed in the folder containing *C. kachinensis* which it closely resembles, but the corona is very different from that species. The description is based on pressed material.

Ceropegia Blatteri[2] nov. comb.

C. odorata Nimmo in Graham *Cat. Bomb. Pl.* (1839), p. 118.

C. ororata Hooker f. *Fl. B. I.*, v. 4 (1883), p. 75 (*non Nimmo*).

Description.—A slender twiner. Leaves narrowly lanceolate or linear, 6-7 cm. x 0.5-1.5 cm., acuminate, base narrowed into the petiole, membranous, hispidly pubescent above and along the nerves beneath, margins ciliate; petiole 0.5 cm. (occasionally there are three leaves at a node.) Flowers 3-10 in peduncled umbellate cymes; peduncle 1-1.5 cm. hispid with stiff hairs, purple (?); pedicels 0.4-0.5 cm., hairy (?); calyx divided to the base, markedly recurved (in the dry state), 5-7 mm. long, linear, acuminate dorsally hispid with a few hairs; corolla 3 cm., very narrow, scarcely inflated at the base, lobes 10-12 mm., the segments very narrow, hairy within; outer-complete, inner corona of five linear-oblong lobes, subacute. Follicles not seen.

The above description I have made from the pressed specimens. Where I have inserted a query. I am not quite certain of the character as there is room for doubt owing to preservation.

It is obvious from the above synonymy that a change of name is necessitated as the specific name *odorata* is preoccupied. The name *C. odorata* Nimmo first appeared in Graham's Catalogue in 1839. The only description accompanying the name is 'Flowers yellow, fragrant: so unusual in the genus'. In the same work there is a reference to another yellow species from Khandala, my *C. Evansii;* in Hooker *f.'s* work there is a reference to a white corolla; Trimen refers to a yellow species from Ceylon. As there is room for doubt, more so, on account of the *very insufficient* description of Nimmo, the name *C. odorata* must be treated as a *nomen nudum.*

Hooker *f.* describes a species under the name *C. odorata* which he says to be the same as Nimmo's *C. odorata,* he may have possibly seen a sheet in some herbarium with the name in Nimmo's hand-writing, but even so, it does not constitute a fully described species and must still be considered a *nomen nudum.* Hooker *f.'s* reference to the colour and scent of the flower is evidently derived from Nimmo's remarks, for it is very evident he had not met with the plant in the field. Hooker *f.'s* description leaves no doubt in my mind as to the species intended, but as the name *C. odorata* is preoccupied it must be changed, and I accordingly do so, as indicated above.

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[1] In honour of Mr. F. E. Bharucha who takes a keen interest in Botany and the activities of the Society.

[2] In honour of the late Rev. E. Blatter who laid the foundation of my botanical studies and guided me much in my work until his untimely death.

SYNONYMY AS CONSIDERED IN MY REVISION OF THE GENUS

1. **C. pusilla** Wight.
2. **C. munroni** Wight (as originally spelt); *C. spiralis* Wight; *C. fimbrifera* Bedd.
3. **C. attenuata** Hooker; *C. angustifolia* Dalz.
4. **C. Lawii** Hook. *f.*; *C. panchganiensis* Blatt. and McC.
5. **C. Wallichii** Wight.
6. **C. bulbosa** Roxb.; *C. edulis* Hort. ex Dcne.; *C. candelabriformis* St. Lag.
7. **C. acuminata** Roxb.; *C. Lushii* Graham; *C. bulbosa* Bamber (not Roxb.) *C. bulbosa* Roxb. var. *Lushii* (Grah.) Hk. *f.*; *C. bulbosa* Roxb. var. *esculenta* (Edgw.) Hk. *f.*; *C. esculenta* Edgw. *C. discreta* N. E. Br.
8. **C. Candelabrum** Linn.
9. **C. tuberosa** Roxb.; *C. Wightii* Graham; *C. mucronata* Roth.
10. **C. intermedia** Wight.
11. **C. juncea** Roxb.
12. **C. elegans** Wall.; *C. sphenantha* Wight and Arnott; *C. mysorensis* Wight; *C. sphenanthera* Dcne.; *C. Walkeriæ* Wight; *C. Gardnerii* Hooker; *C. sphenantha* Hk. *f.* (index); *C. Walkeræ* Trimen (spelling).
13. **C. longifolia** Wall.; *C. lanceolata* Wight; *C. borii* Raiz.
14. **C. Thwaitesii** Hooker.
15. **C. ciliata** Wight; *C. ensifolia* Bedd.; *C. albiflora* Hk. *f.*
16. **C. hirsuta** Wight and Arnott; *C. hispida* Blatt. and McC.
17. **C. Jacquemontiana** Dcne.; *C. hirsuta* W. and A. var. *Jacquemontiana* Hk. *f.*; *C. Stocksii* Hk. *f.*
18. **C. vincaefolia** Hooker.
19. **C. oculata** Hooker; *C. ophiocephala* Dalz.
20. **C. angustifolia** Wight.
21. **C. pubescens** Wall.
22. **C. Hookeri** Clarke.
23. **C. lucida** Wall.
24. **C. Decaiseneana** Wight.
25. **C. brevicollis** Hooker *f.*
26. **C. macrantha** Wight.
27. **C. Arnottiana** Wight.
28. **C. Beddomei** Hk. *f.*
29. **C. fantastica** Sedg.
30. **C. polyantha** Blatt. and McC.
31. **C. kachinensis** Prain.
32. **C. nana** Coll. and Hemsl.
33. **C. Evansii** McC.
34. **C. Blatteri** McC.; *C. odorata* Hk. *f.*
35. **C. Farrokhii** McC.

OBITUARY

EDWARD CHARLES STUART BAKER

The Society has sustained a great loss by the death of Edward Charles Stuart Baker at his home in Upper Norwood, London, on the 16th April 1944, in his 80th year. He was the son of E. B. Baker and was educated at Trinity College, Stratford-on-Avon. Following in his father's footsteps he joined the Indian Police in 1883, and his first three years were spent in Bengal, but in August 1886 he was transferred to Gauhati, and thereafter the remainder of his service was in Assam. In 1888 he met in Calcutta the late Dr. Hartert, then engaged on a collecting tour in the East Indies who described him in his *Aus den Wanderjahren eines Naturforschers* as 'the famous explorer and zoologist of the Cachar Hills.'

He joined the Society in 1898 and his first paper 'On the genus *Chloropsis* appeared in the sixth volume of the Journal. Many other contributions appeared from his pen, but it will be for his papers on Indian Ducks and Game Birds that Stuart Baker will always be remembered. The first of the series dealt with the Ducks, and so popular were they that our Honorary Secretary, Mr. W. S. Millard, decided to publish them in book form The book appeared under the title of 'Indian Ducks and their Allies' and was an immediate success and soon out of print. Apart from the financial success, the volume was the means of drawing attention to the activities of the Society, thereby increasing the membership. Realising this, our Honorary Secretary asked Mr. Stuart Baker to write a further series of papers on Game Birds and a start was made with the Snipe, Bustards and Sandgrouse, later followed by others on the true game-birds, and finally on Rails and Waders, of which so many kinds are found in India.

In those days the editors had great difficulty in making the *Journal* interesting to the wide circle of members. Long contributions on Micro-Lepdoptera, descriptions of butterfly larvae etc. were of scientific importance but of little interest to the ordinary reader, so that the value of Mr. Baker's papers in popularising the *Journal* must never be forgotten. Apart from that they also brought our knowledge of the different birds up to date.

In addition to his interest in Indian birds' eggs in general, Mr. Baker made a special study of the eggs and habits of the different Indian cuckoos and their fosterers. This huge collection consisting of some 6,000 eggs of cuckoos was obtained partly by his own collecting and that of his native collectors, as well as by his numerous correspondents all over the Indian Empire. He also acquired by purchase the collections of 25 of the principal collectors of Indian birds' eggs. These, however, were not mere collections of eggs for most of the clutches were accompanied by notes. He wrote many papers on the habits of cuckoos and their eggs, but it was not until he retired from the Dock Police that he was able to study his collection to the full. In 1942 he published 'Cuckoo Problems', the result of his years of careful observation and collecting.

Besides eggs, Mr. Baker made a considerable collection of skins. Some he gave to the Society, others he disposed of to Lord Rothschild, but the majority he sold to the Royal Museum in Sofia. His collection of cuckoos' eggs was acquired by the Trustees of the British Museum and came to the Museum after his death. Some years earlier he had presented his general collection which consisted of some 49,360 eggs belonging to 1960 forms.

Mr. Baker was fortunate in spending his service in the more remote and less known parts of Assam. He was from 1887 to 1899 in different parts of Cachar, and in 1900 was transferred to Dibrugarh where he remained for two years before going to Shillong as personal assistant to the Inspector-General of Police. In 1906 he became Deputy Inspector-General of Police in charge of C.I.D., which appointment he held until he was promoted in 1908 to Inspector-General of Police for Eastern Bengal, and in 1909 he was transferred from Shillong to Dacca. Later in the same year he was placed on special duty, and in 1911 he retired from Assam and returned to England

E. C. STUART BAKER.
1925.

where he assumed charge of the Port of London Police. This force he re-organized and brought up to a high standard of efficiency, and finally retired in 1925.

After he came to live in London Mr. Baker was able to devote much of his spare time to ornithology, and in 1913 he was elected Secretary and Treasurer of the British Ornithologists' Union, which office he held until 1923.

In 1913 the late Colonel Harington and Mr. Baker commenced revising the Indian avifauna. The former wrote a revision of the Indian *Timaliidae*, while the latter published reviews on the Silver Pheasants and Drongos. Early in 1920 the authorities at the British Museum were asked by the editor of the *Fauna of British India* to suggest someone to undertake a new edition of the volumes on Birds, and Mr. Baker was recommended. The first edition by Oates and Blanford was published in 4 volumes, but in the new edition it was found necessary to expand the work into six, with two additional volumes on synonymy.

For the next eight or nine years Mr. Baker was busily engaged in writing this important work, but he first prepared a Handlist of the Birds which was published in our *Journal*. At the commencement he was only able to devote his spare time to writing and research, but by starting early in the morning and working late he managed to get the first volume out in 1922. Thereafter a volume appeared yearly, surely a record for a publication of this magnitude.

When he retired from the Dock Police in 1925 Mr. Baker became a candidate for the Croyden Municipal Council and was returned by a large majority. For the years 1938-39 he was elected Mayor and continued to sit on the Council till 1942 when he retired. He was much interested in youth organizations and was a great supporter of Amateur Boxing both while in the Police and at Croydon, where he was President of the local Amateur Club.

Mr. Baker was a great shikari and wrote interesting accounts of his experiences with big game in our *Journal*, as well as the *Field* and *Asian*. He was a good rifle shot, and was twice tossed by a gaur and trampled on by a rhinoceros. Many years ago he lost his left arm in an encounter with a man-eating panther near Silchar. He was following the animal which had taken refuge in a native hut, when it charged and knocked the rifle out of his hand. The panther seized him and to save himself he thrust his left arm down the beast's throat. Luckily his shikaries came to his assistance and despatched the animal. Despite the loss of an arm he continued to shoot both with rifle and shot-gun.

Mr. Baker was an excellent tennis player, and in 1937 won the Men's Singles Handicap at Dulwich. He was also a keen rider and won numerous pony races in Assam. With his single hand he was extraordinarily clever and it was wonderful to see him place a small egg in a box of sand and inscribe it. He was awarded a C.I.E., for his services in India in 1932, and after the last War was made a Companion of the Order of the British Empire. In 1897 he married Ethel Mary Roffey, who survives him together with four daughters.

N.B.K.

At a meeting held on the 26th August 1944 the Committee of the Peermade Game Association recorded their sense of regret and loss at the death of Mr. E. C. Stuart Baker and Mr. H. Whistler. [EDS.]

PUBLICATIONS

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The Bulbuls of North Cachar. Vol. VII.

List of Birds' Eggs from North Cachar presented by E. C. Stuart Baker. Vol. VII.

A new Wren from North Cachar. Vol. VII, p. 319.

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Additional Cuckoo Notes. Vol. XVIII, p. 275.
Important additions to the Indian avifauna; The Malayan Hawk Cuckoo (*Hierococcyx fugax*), Vol. XVIII, p. 915.
The Oology of Parasitic Cuckoos. Vol. XVIII, p. 915.
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1895-1906. Notes on the Nidification of some Indian Birds not mentioned in Hume's 'Nests and Eggs'.

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1933. Letter re 'Nidification of Indian Birds' (with note by Editor.) p. 812.

1935. Letter on Native-taken Eggs. p. 475.

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Remarks on eggs of the Cranes. id. p. 24.

Exhibition of a series of eggs of Asiatic parasitic Cuckoos, and eggs of their foster parents. id. p. 34.

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Exhibition of nests and eggs of *Chaetura sylvatica* and *C. indica,* with remarks on the nidification of the genus. id. p. 36.

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1915-16. Exhibition and description of a new Lark—*Mirafra cantillans williamsoni*—from Bangkok. Vol. XXXVI. p. 9.

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Exhibition and description of a new Lark—*Mirafra assamica marionae*—from Central Siam. id. p. 34.

Exhibition of a pair of the rare Cuckoo, *Carpococcyx renauldi.* id. p. 80.

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Remarks on *Prinia sylvatica, Pericrocotus peregrinus, P. speciosus,* and *P. brevirostris,* and descriptions of new subspecies—*Pericrocotus, P. speciosus fohkiensis, P. brevirostris styani.* id. p. 112.

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Correction of locality. id. p. 101.

Descriptions of two new subspecies of Flower-peckers (*Dicaeum chrysorrhaeum intensum* and *Dicaeum trigonostigma rubropygium*) id. p. 108.

Exhibition of eggs of Oriental Shrikes and Flycatchers. id. p. 144.

1921-22. Description of a new race of Flower-pecker (*Dicaeum minullum subflavum*) from Belgaum. Vol. XLII, p. 12.

Proposed the following new names for two Indian birds:—*Alcedo iredalei*, *Upupa epops orientalis*. id. p. 26.

Description of a new race of Laughing Thrush (*Garrulax albogularis whistleri*) id. p. 20.

A paper on 'Some Theories about Cuckoos and their eggs.' id. p. 93.

1922-23. Descriptions of new subspecies of *Sylviidae* and *Turdidae*:—*Acrocephalus concinens stevensi*, *A. stentoreus amyae*, *Hodgsonius phoenicuroides ichangensis*, *Saxicola caprata burmanica*, and *Enicurus maculatus robinsoni*. Vol. XLIII. p. 16.

Exhibition on behalf of Sir Percy Cox and Capt. Cheesman and remarks on eggs from Mesopotamia and the Persian Gulf. Vol. XLIII. p. 70.

Descriptions of two new races of Flycatcher (*Hemichelidon sibirica gulmergi* and *H. s. rothschildi*) id. p. 155.

1923-24. Exhibitions and descriptions of new races of Flycatchers and Shrikes (with remarks on the Indian species of the genus *Cyornis*): *Siphia strophiata fusco-gularis*, *Culicicapa ceylonensis orientalis*, *C. c. meridionalis*, *Lalage nigra brunnescens*. Vol. XLIV. p. 7.

Remarks on the species *Cisticola exilis*, with description of a new subspecies (*C. e. equicaudata*) from Siam. id. p. 38.

Description of a new subspecies (*Franklinia rufescens austeni*) from the Naga Hills. Id. p. 39.

Exhibition on behalf of Mr. H. Whistler, of two clutches of eggs of the Sand-Plover (*Charadrius mongolus atrifrons*) from Chandra Lake, Lahul. id. p. 39.

Descriptions of new races of Warblers:—*Acanthopneuste nitidus saturatus*, *Abrornis superciliaris salwinensis*, *Abrornis schisticeps flavimentalis*, and *Horeites brunnifrons umbraticus*. id. p. 61.

Description of a new race of *Suya crinigera* from Assam for which was proposed the name of *Suya crinigera assamica*. id. p. 80.

1924-25. Description of a new form of *Psaroglossa* (*P. spiloptera assamensis*) from the Khasia Hills. Vol. XLV. p. 14.

Descriptions of three new subspecies of Oriental birds:—*Ploceus manyar peguensis*, *Munia malacca orientalis*, and *Uroloncha striata subsquamicollis* id. p. 58.

Description of a new subspecies of Weaver-bird (*Erythrura prasina coelica*) from Borneo, and proposed new name (*Uroloncha rufiventris*) for bird known as *U. pectoralis* Jerdon. Vol. XLV. p. 84.

Descriptions of new subspecies of Finches :—*Procarduelis nipalensis intensicolor, Passer montanus tibetanus.* id. p. 92.

Remarks on the genus *Sturnopastor* and description of a new subspecies (*Sturnopastor capensis dehrae*) id. p. 103.

Correction re. *Passer montanus tibetanus—P. m. obscuratus.* id. p. 104.

Exhibition of nests and eggs of *Hemiprocne* and *Batrachostomus.* id. p. 104.

1925-26. Descriptions of new races of Sun-birds :—*Aethopyga siparaja mussooriensis, Ae. i. exultans, Ae. g. isolata,* and *Arachnothera chrysogenys intensiflava.* Vol. XLVI. p. 12.

Remarks on Oriental Woodpeckers, with descriptions of new races :—*Picus vittatus dehrae, Picus canus sanguiniceps, Dryobates himalayensis albescens,* and *D. cabanisi stephensoni.* id. p. 69.

1926-27. Remarks on Oriental birds and descriptions of two new subspecies :—*Yungipicus hardwickii brunneiceps, Sasia ochracea querulivox, Megalaima virens magnifica, Rhopodytes tristis nigristriatus,* and *Coryllis vernalis rubropygialis* Vol. XLVII. p. 41.

Remarks on Oriental Owls, with descriptions of four new races :—*Athene noctua ludlowi, Glaucidium cuculoides rufescens, G. c. fulvescens,* and *Ninox scutulata isolata.* id. p. 58.

Description of new subspecies of Oriental birds :—*Alcedo meninting phillipsi* and *Amaurornis fuscus zeylonicus.* id. p. 72.

1926-27. Remarks on Oriental birds and descriptions of two new subspecies :—*Polihierax insignis cinereiceps* and *Cerchneis tinnunculus objurgatus.* Vol. XLVII. p. 101.

On behalf of Prof. M. Menzbier. Exhibition of plates of *Falconidae.* id. p. 91.

Description of a new subspecies of Fishing-Eagle (*Icthyophaga ichthyaëtus plumbeiceps*) from Ceylon. id. p. 150.

1927-28. Description of a new subspecies of Bronze-winged Pigeon (*Chalcophaps indica robinsoni*) from Ceylon. Vol. XLVIII. p. 58.

Exhibition and remarks on a series of Bustard-Quails (*Turnix*), with descriptions of three new subspecies :—*Turnix suscitator interrumpens, T. s. pallescens,* and *T. s. isabellinus.* id. p. 58.

1928-29. Note on the races of *Sterna albifrons.* Vol. XLIX. p. 37. Note on *Ardea cinerea tectirostris* Gould. Id. p. 39. *Ardea imperialis,* nom. nov. for *A. insignis.* id. p. 40. *Squamatornis,* gen. nov., type *Rubigula squamata webberi* id. 40.

Note on *Pericrocotus peregrinus,* with description of a new subspecies :—*Pericrocotus cinnamomeus iredalei* from North and North-West India. id. p. 64.

Exhibition of two series of Cuckoos' eggs. id. p. 64.

1929-30. Comments on C. B. Kloss's communication in the April Bulletin. L. p. 79.

1930-31. Exhibition of eggs of the Greenshank (*Tringa nebularia*) and the Jack Snipe (*Lymnocryptes minimus*). id. p. 45.

Remarks and descriptions of two new subspecies of *Caprimulgus monticolus.* id. p. 100.

1931-32. Lecture on his experience of a visit to Lapland in 1931 and previous years, illustrated with lantern-slides. Vol. LII. p. 30.

1933-34. Description of a new subspecies, *Krimnochelidon concolor sintaungensis,* from the Shan States. Vol. LIV. p. 24.

1934-35. Exhibition of slides, and remarks on, the breeding haunts of several birds. Vol. LV. p. 15.

1935-36. Exhibition of, and remarks on, some slides of Finland and Lapland. Vol. LVI. p. 6.

Description of a new subspecies of Owl (*Strix indranee shanensis*) from the Shan States. id. p. 36.

Bulletin British Oological Association.

1923-26. Exhibition of Eggs of Oriental *Turdidae.* Vol. I, p. 2.

Exhibition of Eggs of Oriental *Paridae.* id. p. 18.

On the Eggs of the smaller Waders. id. p. 55.
Exhibition of Eggs of Oriental Eagles and Vultures id. p. 91.
Exhibition of Eggs of smaller Indian Accipitres. id. p. 99.
On Heredity in Egg Coloration. id. p. 131.
1927-29. On Oology as an aid to Classification. Vol. II. p. 1.
Exhibition of Eggs of Sand Grouse. id. p. 13.
Exhibition of Eggs of Oriental Thrushes and Chats. id. p. 38.
Exhibition of Eggs of Terns and Blackheaded Gull. id. p. 59.
Exhibition of Eggs of Indian Rails. id. 107.
Exhibition of Eggs of smaller *Limicolae*. Vol. II. p. 114.
On the death of Mr. R. H. Read. id. p. 127.
Exhibition of Eggs of *Limicolae* from the Sandman Collection. id. p. 128.
1930-32. Exhibition of a large clutch of eggs of Grasshopper-Warbler. Vol. III. p. 112.
1933-35. Exhibition of eggs collected in Finland. Vol. IV. p. 114.
1936-38. Exhibition of European and Indian Cuckoos' eggs and remarks. Vol. V. p. 7.
1941. Exhibition of Cuckoos' eggs from Europe, and remarks. Vol. VI. p. 27.

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,, ,, ,, ,, big ,, 1944, 8th ,, p. 375.
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Curious and abnormal Horns. 1943, 11th Jan., p. 70.
Gaur from many points of view. 1941, 25th Oct., p. 492.

He also contributed to *The Asian* *1893–1894*.

SOME RECOLLECTIONS OF THE LATE COL. A. H. E. MOSSE, C.I.E.

The obituary of Colonel A. H. E. Mosse, C.I.E., which you reprinted from *The Times* in your issue of April 1944, recalls some pleasant recollections of him which may interest some of your readers. Our mutual friend, Mr. W. S. Milard, gave me an introduction to him about twenty years ago when I was rather indignant at learning that permission had been given to an English officer to shoot some Indian lions for the American Museum of Natural History, whereas the sole representative of this interesting animal in the British Museum was the skin of one of the original specimens shot by Captain Smee. This had been mounted for exhibition in the gallery and when unstuffed was found to contain a tiger's skull! There was thus no skull in the national collection, although, it is true, there were a couple of skulls of Indian lionesses in the Museum of the Royal College of Surgeons which Captain Smee had presented to Sir Richard Owen. Incidentally I may mention that these two skulls, together with a large number of additional valuable, irreplaceable specimens, were destroyed by a bomb during the air-raids of 1940-41.

When I explained the state of affairs to Mr. Millard and told him how eager I was to secure for the British Museum skins and skulls of the Gujerat lion, it occurred to him that Colonel Mosse might perhaps be able and willing to help. Through his kind offices I got in touch with Colonel Mosse, with the result that he very kindly interested H. H. the Maharaja of Bhavnagar in the matter and the latter generously presented three skulls from Amreli, the first the national collection had ever received.

Subsequently Colonel Mosse came to see me and during our talk on Indian big game the topic of the panthers of Gujerat was raised. On learning that the British Museum had no specimens from that district and that I was particularly interested to ascertain if they belong to the normal Indian race or to the race found in the Kirthar range he most generously gave me skins from Gir and Bhavnagar in Kathiawar and from Mahi Kantha in North Gujerat and these showed what I wished to know, namely, that the panthers of those areas, like the tigers, reached them from the east and not, like the lions, from the west.

R. I. POCOCK.

BRITISH MUSEUM (NATURAL HISTORY),
November 1, 1944.

REVIEWS

MAN-EATERS OF KUMAON, by Jin Corbett. With an Introduction by Sir Maurice Hallett, Governor of the United Provinces, and a Preface by Lord Linlithgow, Viceroy of India, 1936-43, —xvi, pp. 228, with photograph of Author and five illustrations from photographs. Published by the Oxford University Press, Bombay, price Rs. 7-8.

This is an unusual book. It is also an unique book; for although a number of sportsmen have deliberately sought out and killed man-eating tigers and leopards in the course of their shooting expeditions, there has been hitherto no record, in the hundred and more books on jungle life and shooting in India, of more than quite a few man-eating felines being killed by any one individual.

It is the lot of few sportsmen to have their upbringing and residence amidst hills and forests inhabited by wild animals—tigers such as 'The Bachelor of Powalgarh' almost at the garden gate; and it is not every man with such opportunities of hunting man-eating tigers and leopards who would take advantage of them with the long sustained determination and success of the author.

The success achieved by Jim Corbett during some 32 years in pursuit of the most dangerous and cunning of all wild beasts was obviously due to his early grounding in jungle lore; his ability to move almost as silently as his quarry; his patience, endurance, and unflagging zeal; his mastery of himself and the weapon in his hand; and his courage: not only the ordinary courage of all hunters of dangerous game, but cold courage on protracted lone occasions combined with the faculty of quick decision and nerve unshaken by sudden critical happenings. Added to all this a prime factor towards his success was his very unusual accomplishment of being able to successfully summon to him the male, or the female, tiger by skilful use of his own vocal chords.

In South India a mechanical contrivance is used to call up tigers, but it is by no means as efficient as the human throat trained to the purpose and could not have been used on the several critical occasions related in this book.

Many of the jungle people of India can mimic to the life the calls of chital, barking deer, jackal, monkeys, and some birds; no doubt the author has ability in regard to these and others, as he has—even when suffering from a sore throat, in respect to the langur.

In the course of the stories brought together in this small book there is instruction for those without experience who will read with care and imagination. Among other things there is the need to secure that willing co-operation and confidence of the village people without which little can be achieved; the ability to speak the language fluently; the natural habit of sympathy, kindness, and reasonable generosity in dealings; all this and much more will those who aspire to emulate Jim Corbett find inherent in these seven jungle tales.

In the 'Author's Note' (x-xvi) there are some statements which call for remark. It is true that man-eating tigers are those compelled through stress of circumstances beyond their control—wounds and old age, to kill human beings for their food: but wounds and old age do not cover *all* cases as the author contends. Tigers with no wound and in the prime of life have become man-eaters. There is, for instance, the unimpeachable record of a tiger in Assam having taken to man-eating without any excuse. (*Journal, B.N.H.S.*, Vol xxxvii. p. 112.) This beast killed 52 people in eight months. Other instances of the kind could be sought out.

The author does not know a single instance of a cub, after it had left the protection of its parent, or after that parent had been killed, taking to killing human beings.

In another part of India, the south-eastern portion of the Central Provinces, there have been man-eating tigers and panthers for more than a hundred years, and possibly for a much longer period than that. All these cases, in a country well stocked with wild animals, cannot have been due only to old age or wounds. It is highly probable that a tiger, having previously learnt the vice from a parent or companion, teaches the cubs by example to kill human beings, and such cubs, when grown up, teach the vice to their cubs: and so the practice never dies out among the tigers of that district. No other explanation could satisfy the case of the area referred to above.

The author has known no exception to the general rule he expresses that tigers are responsible for *all* kills taking place in daylight and leopards for *all* kills after dark. Generalities of this kind are not safe. Many instances of man-eating leopards killing human being by daylight could be cited from other parts of India, the above mentioned tract in particular.

Another matter. The author has not seen a case where a tiger has killed without provocation more than needed to satisfy its hunger or that of its cubs. That generality also is confuted by many instances in other parts of India. Your reviewer has himself seen a number of instances of a single tiger killing at one time two animals out of a herd of cattle; and has a photograph showing eleven out of thirteen cattle—cows and calves, slain in one cattle shed in one night by one male tiger.

Conditions in the Kumaon tract are somewhat different to those in other parts of India and this should be taken into consideration when reading Jim Corbett's observations. All will agree with the author in his praise of the tiger and that, as has been said by the present writer on several occasions, public opinion should curtail excessive slaughter of this fine animal so essential, with the leopard, in preserving the balance of nature in the aforesaid areas of this country.

Is the leopard to a certain extent a scavenger? In the peculiar conditions of Western Kumaon he has apparently sometimes taken to eating human bodies; and there is record (*Journal, B.N.H.S.*, vol. xv, p. 135) of analogous circumstances bringing about a similar state of affairs; also one of the results of the great famine in Gujerat between 1901-1903 was a marked increase in the numbers of man-eating tigers and panthers (*Journal, B.N.H.S.*, vol. xxxvii, p. 110.) With these exceptions the experience of the writer extending to over fifty years and many parts of India, including Eastern Kumaon, is that the panther is no more of a scavenger than the tiger. Both will feed on carcasses of animals not killed by themselves, and both will eat the most horribly putrid flesh. In this respect there is not much to choose between them, indeed the tiger is perhaps the worse offender of the two.

It is good to read that the author very strongly objects to the leopard being classed as vermin. Your reviewer has expressed a similar opinion on several occasions.

As to leopards and porcupines Corbett remarks that leopards do not get quills struck into them, as do tigers, being clever enough to seize the porcupine by the head. The present writer, and many sportsmen, have seen many instances of panthers injured by porcupine quills. In the *Journal, B.N.H.S.* vol. x, p. 154. is record of a panther having died on account of a number of quills in various places and quite a number in the throat. 'One paw was in its mouth, and on removing it and looking down the throat I noticed quite a number of quills sticking up which apparently were the cause of the animal's death.'

The reader with experience will think the author was taking undue risks by carrying around a .275 rifle. It is true that this light weapon did, on one occasion, by reason only of its being light in weight, save his life. But a slightly heavier rifle, say the .375 with a bullet of 270 grains instead of only 172 would have been no more difficult to use under the circumstances related, and would have been at all times a proper weapon to carry in the hills both in his own interest and that of the people and his purpose. It is also for remark that the author on some occasions handicapped his efforts, so vital to the people he was aiding, by not having a comfortable and well concealed seat in a tree, for discomfort means movement and that may be fatal to success. A canvas seat with rings and ropes attached is easy to carry even when one is alone, and will afford a quickly adjusted and secure seat in any tree. Foot rest and leaf screen is arranged all round and below: that way success is more probable.

All along the author quite rightly emphasizes the need for making sure the rifle is loaded. That lesson was no doubt rubbed in on some early occasion. That habit, and the necessity of carrying ample cartridges (superstition —not the author's—as to going out with five only, or seven, is mere foolishness) these in a cloth pouch, each round separate, the pouch being sewn on inside coat pocket, or carried on a belt if coat not worn. That way one puts on a proper cartridge supply with one's garments and they do not fall out of the pocket or become dented. This, and the loading habit, was tragically burnt into the consciousness of the present writer over fifty years ago. These are valuable lessons never to be disregarded.

In the delightful tale of the valiant Robin of treasured memory is an incident teaching three lessons; one of these is to carry one's own weapon, and to use a noiseless sling facilitates this, and is useful at all times especially when alone.

In connexion with two narrated happenings it may be remarked that the weight of a full-grown tigress is 270-290 lbs.; and the green skin of such—with head and paws attached, is fifty lbs.

The author does well to warn against the head shot. He does not mention the use of a wire tethering rope, so essential if it is imperative to prevent the kill being dragged. Very rightly is the stalking of kills recommended, and the reader will accompany Jim Corbett in his stalk of the Mohan tiger, minute by minute, and step by step, with breathless interest.

How true it is that through religion wild life can be effectually safeguarded! In these days of fast disappearing wild birds and animals almost all over India it is only through a properly inculcated public opinion and a feeling that it is against religion to destroy that the situation can be saved.

Most sportsmen have known how deer, and some other animals, become restless and uneasy when watched from cover with intent to kill. This 'sixth sense' influence, which serves as a warning of danger, affects some animals and not others, some human beings and not others. The present writer has always found it does not work against carnivora, but Corbett instances a case when the influence woke a tiger from his sleep. Yet, another time, when the influence should have warned the tiger—not the same animal—of the rifle pointed at his sleeping head from a distance of a few feet . . . he died unwarned. So, as regards tigers, the case appears 'not proven'. An interesting article on the 'sixth sense' appeared in *Blackwood's Magazine,* July 1931.

Jim Corbett was truly fortunate to have had the constant protection of this warning of the near presence of a man-eater seeking his death; his being alive to-day is indeed a case of the 'survival of the fittest'.

Readers desirous of emulating the fine example set by this book would do well to possess themselves of *Wild Animals in Central India,* by Dunbar Brander, with special reference to the following up of wounded carnivora.

The chapter 'The Fish of my Dreams' serves as a pleasing interlude to the tiger stories and will be enjoyed by all readers.

The final chapter illustrates the marvellous success of the author in calling up tigers, as many as six having been summoned to the ciné-camera studio with the results before us.

The author has spelt langur and chital in the usual way, but departs from present day usage in respect to some other animals and birds. Sambar, kakar, kalij, chukor, should be as here written. No doubt they will be so spelled in future editions.

Tribute is paid to the unsung courage of the simple people of the Kumaon hills; many are the deeds of unthinking heroism performed by the jungle-dwelling peoples of India: some few only become known and rewarded.

Jim Corbett says he has not the ability to paint word pictures. All who read his book will feel that his style of writing is exactly the medium for this true and unassuming account of some few of his adventurous deeds: and will eagerly look for more from his pen. He has earned not only the gratitude of the villagers of Kumaon.

The author is devoting the whole of the royalties of this edition to St. Dunstan's Hostel for Indian Soldiers blinded during the present war. There will be a wide and ready sale with call for several reprints.

R.W.B.

2. THE CUCKOO AND OTHER BIRD MYSTERIES. By Bernard Acworth. Pp. 1-198. London, 1944 (Eyre & Spottiswoode). Price 10/6 nett.

The author, a distinguished retired naval officer, is, as he tells us, not a scientist but one who has devoted many years to a close study of the flight factor in birds. The diversity of his interests is disclosed by the list of other books he has written, opposite the title page. Most of his assumptions and theories regarding other bird mysteries are based on the writings of well-known ornithologists rather than on personal observation or knowledge. He is a firm believer in the Duke of Argyll's dictum, which he quotes again and again, that it is 'by thinking, not by observing (the method most exclusively employed by professional scientists and research workers) that hidden truths are brought to light'. To which it is perhaps necessary to add that he is a Fundamentalist, who believes in the doctrine of special creation. He attacks the tendency of modern scientists to treat the *Theory* of Evolution as a *Creed*, maintaining that it is in direct conflict with the Christian faith. He rejects explanations of such bird 'mysteries' as migration and cuckoo problems based on evolutionary grounds and suggests alternative explanations with a pleading for a 'Personal, Purposeful God who makes provision for every physical need of the meanest creature that walks, swims or flies—creatures which are utterly helpless to feed, warm or protect themselves.' In general, the author launches a 'Jehād' against men of science, particularly ornithologists, who 'deign to write and talk on subjects connected with flight without sufficient knowledge or understanding of many of the simple laws of physics.' The focal point of his attack is Prof. Patten who, in an article in *Discovery* (British Association Number, Sept. 1927) appears to have claimed that the bird is able to overcome the laws governing air currents and is more or less independent of them. Acworth is no respecter of the tribe of scientists, no matter how eminent, and practically every current scientific doctrine from Evolution and Natural Selection to Vitamins and Tropisms comes under his lash. He dubs them all 'merely high sounding scientific terms for nothing in the world but a cloak for muddled thinking and ignorance.'

The book may be mainly divided into two sections. The first deals with the laws of wind currents in relation to bird flight, and their bearing not only upon migration, but also on other aspects of bird life. The second part of the book is concerned with some cuckoo problems as discussed in the recently published works of Edgar Chance (*The Truth about the Cuckoo*) and Stuart Baker (*Cuckoo Problems*).

The author brings his own observations, supported by modern researches in aerodynamics, to explode the common belief, which has largely dominated the question of bird flight, that winds exert varying pressures upon flying birds. He shows convincingly that no bird or insect is subject to any pressure from the movement of the medium in which it is supported and in which it is flying. Birds indeed do not feel—except only after alighting on a tree, land or water—from what direction the wind is blowing. They travel, so to say, in a 'moving calm.' The only material difference it makes to the bird whether it flies with or against a wind current is in relation to a given distance to be covered between two fixed points on the earth. In the former case its 'ground speed' will be accelerated; in the latter reduced. In the latter case exhaustion *may* result, not from any buffeting with the gale but from the longer time and greater energy expended in flying continuously to make the goal.

The whole of this section is built around one main assumption—an assumption that does not seem unwarranted—namely that birds possess a well-developed Sense of Direction. This is what guides migrants between their summer and winter quarters over vast featureless expanses of land and sea. The prompt return of breeding terns, swallows and other birds transported from their nesting sites in closed baskets by ship, rail and aeroplane to distant parts and released from different points of the compass, as well as other data provided by such experiments, does in fact suggest that it is an innate sense of direction rather than recognition of landmarks or some other factor which is responsible for guiding the bird to its goal. The suggestion is not a new one, but the way it has now been co-ordinated with the laws of wind currents strengthens its plausibility. During normal years the direction of the winds prevailing at the relative seasons is more or less constant. This explains why migrating birds travel over *roughly* the same route, which may not necessarily be the shortest ground distance between the points. Such questions as territory, nest-desertion, reunion of the sexes in successive seasons, monogamy, and many other mysteries of bird life are all sought to be explained by the combination of the laws of wind currents and the inherited Sense of Direction. Some of the author's conclusions, though seemingly far-fetched, provide stimulating food for thought, and his arguments merit careful reflection.

The second part of the book, dealing with cuckoo problems and controversies, is unfortunately far less convincing. Existing theories on the many 'mysteries'—origin of the parasitic habit, timing of egg-laying, matching of cuckoo egg with the fosterer's, method of laying in 'inaccessible' nests, and so on—are examined and disposed of as unsatisfactory. On p. 164 reference is made to the tailor bird's nest 'sewn into a single leaf which sways in the wind, and with the entrance hole in the bottom' (*sic*).

The most astounding section is certainly the one that is propped up solely around the derivation of the word 'cuckold' as it has been consistently used in ancient and modern languages, namely to denote the *foster-mother* rather than the wronged husband. From this etymological 'clue' the author is led on by devious flights of fancy to the question which heads his final chapter: Is the Cuckoo a hybrid? On the strength of the too literal meaning of another word, 'Inaccessible', as used in the literature for certain types of nests (not capable of being laid in by the cuckoo in any of the known methods), he argues that since cuckoo eggs are found in such nests nevertheless, therefore the agent for their introduction must be other than the cuckoo; and the only possible agent must be the female fosterer herself! 'In other words', he continues, 'may not that innocent-looking foster-mother, as the Ancients inferred, be in truth the cuckoo's *mistress*; the little foster-father really the cuckold, and the resulting cuckoo a *natural hybrid*?'

This does sound like a leg-pull, and we must confess that we have seldom been confronted with a more fantastic 'scientific' theory, apparently put forward in all seriousness. The exploiting of etymological 'clues' to probe biological 'mysteries' is certainly a novel idea! All the major mysteries of the cuckoo, except the origin of the cuckolding habit, are claimed to be satisfactorily solved by this simple device. But the pages of extraordinary argumentation that follow in bolstering up this 'Cock and Bull' hybrid theory add to amusement rather than conviction.

In fairness it must be said that the author confesses his theory *is* fantastic, and is not unaware of the objections by which it is faced. He has forearmed himself by attempting to mollify them in his own way. His arguments are, however, so whimsical and insecurely founded that one feels they cannot *really* be meant to be taken seriously, even from a man who admits his ignorance in such matters 'because his detailed biological and physiological knowledge is almost non-existent'. We do not feel disposed to quarrel with this admission. In a measure it accounts for some of the highly fanciful notions he permits himself to entertain. He believes that his analysis of the 'apparently insuperable' objections to his theory makes them less insuperable. Readers will agree to differ. The whole of the ramshackle structure is built on the ridiculous assumption that birds so different as the cuckoo and the pipit, for example, can and do cross regularly, and that the female cuckoo is a purely non-reproductive creature laying only infertile eggs! Cuckoos and many of their fosterers normally belong to entirely different Natural Orders—almost as different, in fact, as say a hyaena is from a goat. Any one who can believe that such a cross is possible not once, not twice, but repeatedly and in the ordinary course of nature will believe anything. But it may be mentioned that we have no evidence that such crossings are at all possible. The author's remarks about male mules *sometimes* being fertile when crossed with either mares or she-donkeys in no way improve his case.

This is a book that certainly deserves to be read if only to satisfy the reader that the age of 'scientific' Don Quixotes is not past; that even today are not wanting bold men who, armed with the archaic bow and arrow and fortified by charms hung round their necks, will have the hardihood to pit themselves against machine guns and trench mortars on the field of scientific controversy.

S. A.

3. THE AVIFAUNAL SURVEY OF CEYLON conducted jointly by the British and Colombo Museums. By Hugh Whistler. *Spolia Zeylanica*, vol. XXIII, pts. 3 and 4 (Aug. 25, 1944) pp. 119-321 (with 1 map and 8 plates)—Price Rs. 6/-

For well over a decade the name of Huge Whistler has been to the fore in Indian ornithology, and deservedly so. For his excellent and painstaking taxonomical work in connection with the series of recent bird surveys, sponsored by the Bombay Natural History Society, he will be remembered with gratitude by future generations of Indian ornithologists. As one who had the privilege of working in close collaboration with Whistler for many years, and therefore familiar with the thoroughness with which he conducted his researches, the reviewer can realise to the full the loss which Indian ornithology has suffered by his untimely death. This review is as much an appreciation of the man as it is of his latest contribution to our knowledge of Ceylon bird life. Throughout his reports on the material collected in peninsular India could be sensed the handicap under which he had to work owing to the lack of fresh material for comparison from Ceylon. It was due chiefly to Whistler's initiative that the Ceylon survey took its inception. It is fornate for our science that the taxonomical work had been completed and its results written up before the author's death.

This paper will serve the purpose of a handlist of the Birds of Ceylon. It brings up to date the ornithological position where it had been left by the publication of the 2nd edition of Wait's Birds of Ceylon in 1931.

The avifauna of Ceylon is of particular interest, and from many points of view. Ceylon is almost the southernmost land mass of any size before the Antarctic is reached. It receives no summer (breeding) visitors from the south, and is the southern terminus of the North-South tide of migration. It is situated near the Equator, and apart from the South-West Monsoon it possesses no well-marked seasons. Such local movements among the birds as take place, even altitudinal ones, are controlled by humidity, rainfall and exposure to monsoon rather than by cold. As one would expect from its extensive coastline and geographical position, Ceylon is particularly rich in sea and shore birds: Petrels, Shearwaters, Gulls, Terns and Waders (*Charadriidae*).

It is well known that island populations, by virtue of their geographical isolation, tend to produce forms which are markedly different from their representatives on the mainland or on neighbouring islands. The species-formation here is rapid, and largely due to individual variations of a dominant kind being preserved and accentuated through forced interbreeding of small closely related populations. Thus it is not surprising to find that in Ceylon there have developed a large number of specialised forms. 22 species and no less than 77 subspecies (74 of the latter being Passerine) are peculiar to the island. Moreover, several of the species belong to genera that are unrepresented on the Indian mainland. Nine of these endemic species are euryzonal—that is to say they occur in all the 3 zones into which the island is naturally divided: Low Country Dry Zone, Low Country Wet Zone and Central Hill Zone. 5 occur only in the Wet Zone (both hill and plain), and 8 species are entirely restricted to the Hill Zone. An analysis of the avifauna as a whole does not, according to the author, bear out the oft-quoted direct connection between Ceylon and Malaysia. He considers the Ceylon avifauna to be merely a specialised segment of the Indian.

The races peculiar to Ceylon differ from the neighbouring South Indian races chiefly in being smaller in size and darker in colouration. A point of greater interest is that in many of these—to be exact, in 22 out of 77, or a little over 28%—the bill is appreciably more developed. Elsewhere it has also been noted that a large percentage of insular races—particularly of Passerine birds—develop large bills, but the reason for this is not obvious. Another peculiarity of the endemic Ceylon races is the tendency in forms showing marked sexual dimorphism elsewhere, for the male and female to look alike. To such belong the Shama, the Pied Shrike and the Magpie Robin to mention a few. In the case of the Ceylon Paradise Flycatcher the white plumage of the adult male is completely suppressed, so that he always remains chestnut. Curiously enough side by side with this, certain seasonal differences in continental Wren-Warblers—e.g. of the genera *Franklinia* and *Prinia*—which in the past have been the cause of some confusion and much controversy in the taxonomy of Indian races, have also been completely suppressed in Ceylon. Thus, *Franklinia gracilis pectoralis* (Legge) wears the summer type of plumage, with ashy pectoral band, throughout the year. The noticeably long tail developed by the Indian *Prinias* in winter is suppressed, and in Ceylon there is no different summer and winter plumage. All this is presumably correlated with the fact that there is no well-marked breeding season in Ceylon.

The resident races of the Kentish Plover and the Black-winged Stilt are remarkable for their failure to adopt the distinctive breeding dress of their typical forms—the chestnut cap of the former and the black crown and nape of the latter.

But against this general levelling up of the sexes there exists the anomaly that in the Ceylon race of the Painted Partridge (*Francolinus pictus watsoni*) the female apparently differs from the male to a far greater extent than in the Indian bird.

Attention is drawn to the fact that a good deal has still to be learnt concerning the moults and breeding periods of Ceylon birds. One often sees it asserted that such and such a bird is 'double brooded'. What exactly does this mean? Is it implied that in the same individuals there is a recrudescence of the gonads twice, at different seasons during each year? Or is the term used loosely for the species as a whole meaning that one set of individuals breeds at one season and another set at a different period of the year? If the former is the implication, have we any real evidence for it in the case of wild birds? Or is the term 'double brooded' simply used in the sense that two broods are reared in succession—in which case why not 'triple brooded' also?

The many points and difficulties requiring special attention and elucidation have been clearly set out in the text under the relevant forms. One is constantly stumbling upon them. Therefore, no resident ornithologist eager to do further work on Ceylon brids need run away with the illusion that the Ceylon survey and Hugh Whistler have left nothing further for him to do! Several of the points needing clarification are not confined to Ceylon birds, but are a challenge to Indian ornithologists as well. What for instance is the nature and purpose of the naked dark-pigmented spots on each side of the Tailor Bird's throat? What is the precise connecting link between the Palm Swift and the Palmyra Palm? [The author calls the bird a 'parasite' (*sic*)]

A further peculiarity of many Ceylon races, not so easy to explain away was pointed out by Legge long ago 'in which the North Indian bird is found to extend to Ceylon over the heads, so to speak, of South Indian and neighbouring species'. This is seen for example in the White-eye, *Zisterops p. egregia*, which in both colour and size is very close to the North-west Indian *occidentis* although separated from it by about a thousand miles and two other races in peninsular and South India! Similarly the Barred Owlet from the Low Country Dry Zone of Ceylon is identical with the greyer bird of Mysore and North India and differs markedly from the more rufous *malabaricum* which is its next door neighbour, as it were, in the Travancore area.

The complete absence of all vultures from Ceylon is a no less amazing or inexplicable phenomenon.

Many species have developed a Wet Zone and a Dry Zone race within the circumscribed limits of the island. These one imagines, would provide exceptional opportunities for a thorough-going ecological study.

P. 189: The type-locality of *Fringilla amandava* Linn. is omitted. It should of course be India orientalis—restricted to Northern Guzerat.

P. 226: *Alcedo atthis taprobana* is said to differ from *A. a. bengalensis* in having the upper parts more markedly blue in colour as opposed to green. There is no difference in size. The reviewer wishes it was as simple as that. But he has often been totally unable to place many specimens in collections with confidence on the character of blueness or greenness alone. Is not the preponderance of blue or green, partly at least a seasonal character and depending on wear? The deception is well known in the case of *Halcyon smyrnensis* where amongst a resident population some individuals appear deep blue while others cannot be described as anything but green. In the case of this Kingfisher the author himself has admitted elsewhere (*J.B.N.H.S.*, vol. xxxvii, p. 761) that 'the tint of this colour varies individually and is affected by wear'. I believe exactly the same holds good with *Alcedo atthis* also.

P. 279: It is surprising to read that the author knows no record of the Bar-tailed Godwit from anywhere in India except the Sind Coast and Bihar (in the neighbourhood of the Ganges). Records of occurrences in the neighbourhood of Bombay were published on p. 639, *J.B.N.H.S.*, vol. xl (May 1939).

P. 297: In view of the assertion that still continues to enjoy currency, it is good to be told that the tradition of the Flamingo's breeding in Ceylon has not yet been substantiated. Considering what a large and unmistakable bird the Flamingo is, it is indeed amazing how little we do know about its life history and movements in India. The only definitely known breeding grounds within our limits so far are on the Great Rann of Kutch. An appeal for notes on the movements of this species, published in the *Journal* a few months ago, has produced poor response.

The map unfortunately is just too badly printed to be of much help as a map. The plates, mostly by W. W. A. Philips, are excellent, but their reproduction could have been better.

S.A.

BOOKS ADDED TO THE SOCIETY'S LIBRARY.

1. *Evolution: The Modern Synthesis*, by Julian Huxley.
2. *Bird Flocks and the Breeding Cycle*, by Fraser Darling.
3. *Social Life of Animals*, by W. C. Alee.

THE BOMBAY NATURAL HISTORY SOCIETY'S ROSY PASTOR ENQUIRY

The Rosy Pastor or Rose-coloured Starling (Hindustani: *Tilyer* or *Wyha*) is one of the most prominent of the migratory birds that spend the winter months in this country. It enters and leaves India on a restricted front between the foot of the Himalayas and Central Baluchistan, travels over the high ground of North Baluchistan, Central and Northern Afghanistan and Persian Khorasan to the S.-E. corner of the Caspian Sea. Its breeding grounds lie in Russian Turkestan and westward to Turkey and beyond in S.-E. Europe, normally as far west as Hungary. Beyond Indian limits it provides one of the most remarkable instances of east to west migration known among birds.

The Pastor is one of the earliest winter visitors to arrive in India, vanguards often passing through the North-west Frontier Province in the second or third week of July. The birds leave N.-W. India as late as May, so that the species is completely absent from here for only about two and a half months in the year. Once within our boundaries it spreads out over more or less the entire peninsula, east to Western Bengal and south to Ceylon. It is, however, most abundant in N.-W. India and south to the Deccan.

Apart from its interest as a migratory species, the Rosy Pastor is a bird of very special economic importance. On the one hand it is a relentless enemy of the locust whose swarms are notorious for their depredations to crops and vegetation; on the other hand the bird itself causes considerable damage directly to mulberries and grapes and to ripening cereal crops, particularly to jowāri.

It is also an important agent in the fertilisation of a large variety of flowers and in the seed dispersal of many plant species both beneficial and harmful from the economic point of view.

Large numbers of Rosy Pastors have been ringed or 'banded' as nestlings in Russian Turkestan and Hungary. Only one of these (from Hungary) has so far been recovered in India. In N.-W. India, where the Pastor is largely shot for food, a proper look-out would perhaps produce further records of recoveries.

The Bombay Natural History Society is anxious to collect all available information concerning the life history and seasonal movements of the Rosy Pastor in India, and if possible also along its migration route beyond. To help observers in collecting some of the desired information, a simple questionnaire is appended. It is requested that this questionnaire, or as much of it as one is able to fill, should be returned to the Bombay Natural History Society (114 Apollo Street, Fort, Bombay) by the end of May each year. The information will here be sorted out, tabulated and filed until sufficient data has accumulated to justify publication.

For the benefit of those not acquainted with the bird, a description is given:

Size.—About that of an English Starling, or Common Myna.

Description.—Whole head, long bushy crest, throat, upper breast, wings and tail glossy black, the feathers lightly tipped buff; thighs, a patch on each flank and under the tail black tipped with white; remainder of the plumage 'rose colour' (Whistler). The crest usually lies flat on the crown and projects behind the head. It is seldom carried erect.

Sexes more or less alike, but young birds are pale brown with only the wings and tail slightly darker. Seen in small parties or large flocks, sometimes numbering several hundreds.

QUESTIONNAIRE.

1. What part of the country do your observations refer to?
   (Give a rough indication whether desert, semi-desert, cultivation, urban, etc.)
2. Earliest date seen.
3. Latest date seen.
4. Status?
   (Whether seen throughout the winter or part of the time; or only temporarily on autumn or spring passage, or both).
5. Can you correlate their presence in your area with food—i.e. the ripening of any particular crops or fruit?
6. While in your locality what were the birds principally feeding on?

Any other information you can supply will be welcome, e.g. whether immature birds or adults are the first to arrive, whether the birds travel in mixed flocks of immature and adult individuals, and whether the sexes are separated or mixed on first arrival. This last can only be ascertained by shooting several birds from a flock and sexing them by dissection.

MISCELLANEOUS NOTES

1.—OCCURRENCE OF THE LION IN PERSIA.

I was very interested to read Lt.-Col. G. F. Heaney's note on this subject in your issue for April, as it leaves me in no doubt that the animal which I myself saw was none other than a lion.

My battalion was at the time in camp on the banks of the Kharki River in the gorge it forms between the Zagros Range and Khulian Khu, a very wild country about 40 miles north of Dizful, the time was Christmas 1941.

One day, I and another officer were out after partridge and small game, although we had a couple of orderlies with rifles with us in case of a shot at a mountain sheep or ibex, it was late in the afternoon when my friend and I went to explore a deep fissure in the solid limestone range from which a stream flowed, when looking down, I saw what I took to be a large beast of prey strolling quite leisurely along the edge of the stream. I thought at first it was a leopard but no spots or markings were evident it being a greyish colour all over, I took it to be a large wild cat or something of the nature of the South American Puma. At the time it never entered our heads that it might have been a lion. It had no mane and would I should say be about the size of a small female lion. Unfortunately we had got ahead of our orderlies and by the time we could attract their attention without noise, the beast had turned a corner beyond which we were unable to proceed.

R. N. CHAMPION-JONES,
Capt.

61 Travancore State Labour Unit.
C/o. No. 6, A.B.P.O.
August 4, 1944.

2.—WEARING OF TEETH IN TIGER.

I enclose 3 photos of a tiger's skull. It appears to have been a very old beast, the teeth being worn flush with the gums except for the upper big fangs which were about half an inch out. The skin was dull and tawny though the black marks were still black. The skin was almost parchment thin and one could see the light through it nearly all over the body, the hair was short but there was plenty of it.

I have seen the skin and skull of another very old tiger—a huge beast, and his skin was also tawny but the stripes had gone quite brown and his teeth were huge and absolutely perfect.

The present one was shot by a B.O.R. about 8 miles from here and he said the cow had no marks on it except some scratches on one cheek and its neck was broken. The tiger's claws were perfectly good.

I have the skull and would send it to you but I am afraid of its getting lost with traffic as it is at present.

The tiger—a male—measured 8 ft. 3 in. between pegs but seemed to have shrunk and its skin was very loose on it. Its fore-paws would have suited a much bigger beast. The nerve centres were exposed in almost all the teeth even the back ones.

Langharjan, CYRIL GORE.
Naharkatiya P.O.,
Assam.
August 28, 1944.

[The photos are unfortunately unsuitable for reproduction: They present an interesting case of dental wear resulting probably from a lack of calcium or some such product in the individual. The canines are usually well preserved in old tigers though they naturally show some signs of wear.—Eds.]

3.—WHERE MAN-EATING TIGERS OCCUR

Mr. Corbett's *Man-eaters of Kumaon* has reminded me of a subject I have often discussed with big game shots. I have never heard of man-eating tigers or panthers in the Bombay Presidency in which I spent 30 years of my service, though I made frequent enquiries from British and Indians. I have resided on the Nilgiris for 17 years and made similar enquiries without result. A planter who has shot many tigers and panthers on and around these hills tells me that in 47 years he has only known of one man-eating tiger and no man-eating panther. Yet man-eating tigers and panthers are not uncommon in the Central Provinces and United Provinces, particularly in the latter. There seems to be no reason why this should be so and it would be interesting if you would send a questionnaire on the subject to members of the Society all over India, as well as to the Indian States where tigers and panthers are to be found. I believe that if a line is drawn due east from Bombay across India it will be found that man-eaters are hardly ever found south of this line nor in the north of the Bombay Presidency and Kathiawar. In the latter province there are only panthers and a few lions.

Can you think of any possible solution of the problem?

There seem to be three principal causes for man-eating of which the first is the most common.

1. Injury by gunshot wounds, porcupine or accident which prevent an animal from killing its ordinary prey.

2. Acquiring when young a taste for human flesh from a man-eating mother.

3. Acquiring a taste for human flesh by a chance killing of a man or woman.

All these conditions can be found anywhere in India.

I do not think that scarcity of food need be taken seriously into consideration. If the number of sambhur, chital and nilgai has been reduced by poaching there are pig, porcupine and village cattle and for the panther sheep, goats and village dogs.

I hope you will agree that the subject is interesting enough for investigation.

E. O'BRIEN,
Lt.-Col.

WOODLANDS,
KOTAGIRI,
October 18, 1944.

[Man-eating tigers are comparatively rare though not unknown in the forests of the Bombay Presidency. In Vol. iv of our *Journal* Mr. Reginald Gilbert describes the ravages of man-eating tigers in the Bansda State, which lies north of Bombay in what is known as the Surat Dangs. He also writes of a man-eater killed 35 miles from Bombay, and there is an old record of a man-eater carrying off coolies from a village near Kurla which is a suburb of greater Bombay. Man-eaters are equally rare in the South Inlian hill ranges, though Kinloch (*Journal*, Vol. xxxii, p. 209) records one which killed and ate a coolie in the Nelliampathy Hills. Generally speaking it might be said that man-eating tigers occur more frequently in the dry deciduous forest zone of India (in which the Surat Dangs north of Bombay may be included) and that they are rare and infrequent in the denser wet evergreen forests where there is a sparser human population and less disturbance of normal food supply.—EDS.]

4.—WILD DOGS ATTACKING A TIGER.

The very interesting eye-witness account contributed by Mr. W. Connell as a Miscellaneous Note to Vol. xliv, No. 3, for April 1944, would be yet more valuable if it could be stated whether the tiger was a full grown animal.

As it seems clear that the tiger killed the sambur before the dogs came on the scene, it would appear that in this instance the dogs were the aggressors for the purpose of securing the 'kill' for themselves: therefore it would be interesting to know if the increase of wild dogs in that area has been so great as to seriously diminish the number of wild animals—sambur, pig, etc., available to them as food and so cause them to take such an extreme measure to satisfy their hunger.

One would like to know if the greatly diminished pack devoured the remains of the tiger; and whether the sambur was eaten by the dogs? The carcase of a 400 lb. tiger would have scarcely been within the capacity of the few survivors of the pack.

R. W. BURTON,
Lieut.-Colonel,
Indian Army (retired).

BANGALORE,
July 12, 1944.

5.—EXPERIENCES WITH BUFFALO IN BURMA AND RHODESIA.

My nephew J. McKellar Spence in the 3/4th P.W.O. Gurkha Rifles writes me of an experience he recently had in Burma with a buffalo, and, as when hunting with a friend in the Sobi River

Country Rhodesia, a buffalo, which his friend had wounded, charged when caught up with and forced the hunters to take refuge in trees, I wonder how many men have been 'treed by buffaloes' in Africa as well as in Asia.

My nephew writes:—

'I was in a small clearing, having lunch and stirring some lemonade when I heard a noise and a buffalo appeared and charged straight at me. I jumped for a tree and got up about 4 feet and the buffalo charged past on the opposite side. I could smell his breath as he went past. I lost the lemonade and never found the spoon again.'

PEAR TREE COTTAGE, REGINALD SPENCE.
BLACKBOYS, SUSSEX.
November 2nd, 1944.

6.—ON THE NAME OF THE INDIAN PANGOLIN (*MANIS CRASSICAUDATA* GEOFFR).

I notice on page 592 of the *Journal* for August 1944, that Captain C. R. Stonor gives the pangolin the name *Manis crassicaudata.* Mr. F. W. Champion, in his book *The Jungle in Sunlight and Shadow*, page 25, states that the five-toed pangolin (*Manis pentadactyla*), is the only species to be found in the plains and foot-hills of India.

Captain Stonor also states that the pangolin is known in the hills as *'Udumbu'*. I may say that in the Tamil areas with which I am acquainted, this name is the one given to the Monitor Lizard and not to the Pangolin. In a Tamil Dictionary which I have consulted, the above name is that given to the Monitor, and under 'Ant-eater' I find the name 'Arrunkku', but I am not familiar with this name.

'LANSDOWNE', R. F. STONEY.
OOTACAMUND,
October 26, 1944.

[Geoffrey's name *crassicaudata* is the correct name for the Indian Pangolin. It takes precedence over Linnaeus's *pentadactyla* which he gave to the Chinese Pangolin to which animal this cognomen is now assigned.—EDS.]

7.—THE PERSIAN GROUND CHOUGH (*PODOCES PLESKEI*).

It seems very probable that the Persian Ground Chough just comes within Indian limits in the neighbourhood of Nokkundi on the Iran-Baluchistan frontier. In 1943, Col. R. C. F. Schomberg was stationed for some months at this desert outpost, and told me, in one of his letters that he had seen birds in the vicinity of this customs post strikingly like the Ground Choughs (*P. hendersoni* and *P. biddulphi*) he had so often seen in his travels in Chinese Turkestan. There can, in my opinion, be very little doubt that the birds Col. Schomberg saw were *Podoces pleskei*, the Persian Ground Chough, but definite proof in the shape of a skin is needed before this bird can be added to the *Fauna of British India* (Stuart Baker).

If this note should catch the eye of any member of the Society in Baluchistan who has the opportunity of securing a specimen of this rare bird, I hope he will make every effort to obtain a skin (no matter how imperfect), and forward it to the Bombay Natural History Society. There is a description and plate of this bird by Bowdler Sharpe in Vol. xvii of the Society's *Journal*, pp. 555-557. But since it is not always easy to gain access to this volume, I append the following field identifications :—

In desert areas where there are a few tamarisk bushes, look out for a cinnamon coloured bird, about the size of a hoopoe, with a black tail and throat, and black and white wings, which can run swiftly over sand hills, and perches occasionally on bushes.

C/o POSTMASTER, F. LUDLOW.
SRINAGAR, KASHMIR,
December 23, 1944.

8.—SUNBIRDS AND FLOWERS

With reference to the flowers identified by you as *Hamelia patens* Jacq. in which I observed the Purple-Sunbird taking short-cuts to the nectar, I would like to add the following from my notes :—

March 26, 1944. Both male and female came near the nest, the female feeding on the Tecoma flowers. Neither bird, incidentally, sticks its beak up the centre of the flower, but makes an incision near the base of the trumpet, without harming the stamens, as far as the naked eye can see'.

To this, I would add the further points :—

(*a*) So far I have only observed the male following the alternative method of hovering with rapidly vibrating wings and feeding off both the Tecoma (in March-April) and *Hamelia patens* (August-September); I have never seen the female hover.

(*b*) So far I have only seen the male using the 'short-cut' method on *Hamelia patens*, though there is no reason to suppose the female would not do so too.

While writing the above paragraph, the male sunbird arrived on *Hamelia patens*. Watching feeding operations from 8 yards through glasses, it seems clear enough that the method of tackling the flower depends entirely on how it can best be reached from the branch the bird is perched on. If the flower is on the same level, he sticks his beak right up it to the base of the mandibles; if the flower is on a lower level with the aperture facing away from him, he uses the 'short-cut' method, gauging the distance along the flower up which his beak would reach; if he cannot reach a flower from his perch even by the 'short-cut' method, he has to leave his perch and hover vigorously in front of it.

MAYO COLLEGE, AJMER. J. A. M. EDE.
September 18*th*, 1944.

[Short-cuts by birds to the nectar of flowers is well known in the case of numerous species of flowers and many species of birds. A note on the subject by N. K. Tiwary is published in Vol. XXXII of the *Journal* (p. 378). Further references to the habit will be found in 'Flower Birds and Bird Flowers in India' by Salim Ali (ibid. Vol. XXXV, pp. 573).—EDS.]

9.—PLAINTIVE CUCKOO (?) PARASITISING PURPLE SUNBIRD.

I have just seen a queer sight, namely, a purple-rumped sunbird's nest tenanted by a young cuckoo, probably the 'plaintive'. This monster baby almost overflows from the nest and is fed not only by the sunbirds but also by tailor birds. They seem to take it in turns.

I suppose this case is rather a freak as one would not expect a bird of this size to select one of the tiniest species as foster parents for its offspring.

The nest is in the garden of Major Nabi Khan, next door to the Turf Club.

POONA, M. F. SUTER, D.SC.
August 30th, 1944.

[As far as we are aware, this is the first instance recorded (presuming our contributor's identification to be correct, as seems likely) of a Plaintive Cuckoo cuckolding the nest of a sunbird. The tailor bird and wren warblers, which also build purse-like nests are of course well known dupes. The smaller Emerald and Violet Cuckoos (*Chalcites*) of the Himalayas and Assam are regularly parasitic on various sunbirds.

The Himalayan Cuckoo (*C. c. optatus*) and the Asiatic Cuckoo *C. c. telephonus*) in the Himalayas (as well as the Khasia Hills Cuckoo (*C. c. bakeri* in Assam) frequently lay in the dome shaped nests of tiny birds, e.g., the Grey-headed Flycatcher-Warbler (*Seicercus xanthoschistos*) out of which the young imposter can only emerge by bursting the fabric which surrounds it as tightly as a straight jacket.

The most interesting part of the note, perhaps, is that the baby cuckoo was being fed while still *within* the nest by both tailor bird and sunbird. Young birds *outside* the nest and begging for food have frequently been recorded being fed by birds of different species.—EDS.).

10.—'ALPINE SWIFTS' ON RAMESWARAM ISLAND?

On page 247 in *J.B.N.H.S.* Vol. XL, Mr. Biddulph in 'The Birds or Rameswaram Island' says of the Alpine Swift-*Micropus melba bakeri* (Hartert) :—

> '. . . The numbers increase from December to March when parties of from twenty to forty may often be seen seated on the telegraph wires alongside the railway line.'

So far as I am aware this bird is incapable of sitting on a wire, and there seems an obvious mistake in identification.

MESSRS FAIZ & CO., HUMAYUN ABDULALI.
75, ABDULREHMAN ST., BOMBAY, 3.
BOMBAY, *August 18th*, 1944.

11. SOME RECENT RECORDS OF THE GRIFFON VULTURE (*GYPS FULVUS FULVESCENS* HUME) IN PENINSULAR INDIA—A CORRECTION.

In our paper on the Birds of Bombay and Salsette (*J.B.N.H.S.* Vol. XL, p. 370) we offered very little information about the breeding of the Long-billed Vulture (*Gyps indicus* ssp.) in our area. We have dealt at length with the Griffon Vulture (*Gyps fulvus fulvescens* Hume), but we now find that there has been a mistake in identification. What we have called *Gyps fulvus* all along is, in fact the adult of *Gyps indicus* and the numerous nesting records really refer to this species.

The following other records of *Gyps fulvus* recently published in the *Journal* must also be read as *indicus*.

Sálim Ali in Hyderabad, *J.B.N.H.S.* Vol. XXXII, p. 425.
Sálim Ali in Central India, *J.B.H.N.S.* Vol. XLI, p. 475.
McCann at Mt. Abu, *J.B.N.H.S.* Vol. XLIII, p. 210.
Sálim Ali in Mysore, *J.B.N.H.S.* Vol. XLIV, p. 19.

When dealing with the birds of Travancore and Cochin (*J.B.N.H.S.*, Vol. xxxix, p. 324), S.A. has referred to sight records from that area with diffidence. These should now be treated as relating to *indicus*.

Mrs. M. D. Wright in her notes on 'The Birds of Berar' (*J.B.N.H.S.*, Vol. xliii, p. 440) also refers to *Gyps fulvus* which is presumably also in error for *indicus*.

Koelz in 'The Birds of Londa Neighbourhood,' (*J.B.N.H.S.* Vol. XLIII, p. 28) refers to *Gyps fulvus* and though he apparently shot (and identified?) a bird, his reference to a congregation of 50 individuals makes us doubt this record also. The latter at any rate is obviously erroneous.

Gyps fulvus is really a North Indian bird. A bird shot at Kurla near Bombay by Mr. J. M. Mason in February 1893 is probably its most southern authentic record. This specimen (now in the *J.B.N.H.S.* collection) has a wing of 682 mm. anl is very noticeably larger and brighter cinnamon brown than *indicus*, which has so long masqueraded under this name. It was evidently a straggler. The bird which we have so far recognised as *indicus* is apparently a sub-adult phase of *Pseudogyps*, which has no white on the back nor the white bands under the wings. The bird breeds in this plumage.

The juvenile of *indicus* is similar to the adult which, however, varies in the intensity of colour. The juvenile *Pseudogyps* has no white back but is elsewhere as dark as the parent.

Kirke-Swan in his 'Monograph of the Birds of Prey' gives the following measurements :—

Pseudogyps bengalensis.—Wing 557-608 mm.
Gyps indicus.—Wing 575-679 mm.
Gyps fulvus.—Wing 685-747 mm.

33 Pali Hill, Bandra, SALIM ALI.
Bombay, HUMAYUN ABDULALI.
Sept. 18th 1944.

12. THE BLUE-TAILED BEE-EATER (*M. S. JAVANICUS* HORSF.) IN SALSETTE—A CORRECTION.

The specimen recorded in *J.B.N.H.S.*, vol. xl, p. 169 is really a Blue-cheeked Bee-eater (*Merops superciliosus persicus* Pallas) and not the Blue-tailed (*M. s. javanicus*). In *J.B.N.H.S.*, vol. xliii, p. 104, we have already explained how subsequent specimens obtained in our neighbourhood all proved to be *persicus*. It appears that this is the only race which passes through our area regularly between September and November, and that *javanicus* must be removed from our list.

At Kihim, a small flock suddenly turned up on May 20, 1943, after a night of rain, and the same thing was noted there on May 11, 1944, under similar conditions. Return passage evidently takes place about that time, most birds passing over without coming into prominence unless favourable circumstances, as caused by overcast weather and rain, tempt them to make a temporary halt.

33 Pali Hill, Bandra, SALIM ALI.
Bombay, HUMAYUN ABDULALI.
Sept. 18th 1944.

13.—A PECULIAR HABIT OF THE COMMON PEAFOWL (*PAVO CRISTATUS* LINN.).

Last June, at Hilikha in Assam, I had a chance of observing a peculiar habit of a pair of domestic peafowl. The pair was kept in a large private garden enclosed on all sides by barbed-wire fencing interspersed with bushes and undergrowth. The pair was observed from a distance of about thirty yards outside the fencing.

The male peafowl, with his tail feathers expanded into a gorgeous fan, moved round and round the female in circles in a manner which suggested some form of amorous dancing. After about ten minutes, the male stopped dancing and squatted on the ground as if to pass out something from his body. After a couple of minutes he got up, and the peahen immediately began to eat up something from the ground where the male sat. This at once suggested to me that the male did actually give out something from his body. But from the distance where I was standing it was not possible for me to observe the nature and colour of the material, or the particular region of the body of the male from which it came out.

The above phenomenon cannot with any certainty be explained in terms of hedonic or courtship practices, but at the same time I can see no other explanation.

There is a widespread popular belief amongst the lay public that the females have their eggs fertilized by eating up a material given out by the male, and that this is the normal mode of reproduction in peafowl. But this I believe to be fantastic. There seems no doubt that these birds follow the normal mode of copulation for the purpose of reproduction, although I have not seen it actually in any peafowl so far.

It would be interesting to learn from the readers of these pages, who have either heard of or observed or studied the habits of the common peafowl, if the above behaviour of the birds was in fact some form of courtship leading ultimately to mating.

ZOOLOGY DEPARTMENT, S. H. HAZARIKA.
UNIVERSITY OF CALCUTTA,
35 BALLYGUNGE CIRCULAR ROAD,
BALLYGUNGE, CALCUTTA.
August 21st, 1944.

[The dance of the peacock is well known as a 'self-exhausting' performance. It does not necessarily result in coition though it is the normal prelude to it. The peacock often performs his 'amatory' dance even when there is no hen about, in front of some inanimate object that has roused his emotion, such as his accustomed feeding dish.

The belief widely prevalent in India that insemination in the peahen takes place in the manner suggested in the note is of course groundless. So is the belief that the peahen's eggs are gorgeously coloured, in keeping with the plumage of the cock. The observation was made at such long range and presumably without glasses, that a satisfactory conjecture of what our contributor actually saw is difficult. But a much more simple and convincing explanation occurs to us: the peahen picked up some particle of food that got exposed or merely pecked at the ground idly as gallinaceous birds frequently do.—EDS.]

14.—PECULIAR BEHAVIOUR OF THE BRONZE-WINGED JACANA [*METOPIDIUS INDICUS* (LATHAM)].

On Friday evening, Nov. 10th, I saw what appeared to be the very safe and novel way in which a Bronze-winged Jacana protected its offspring.

Coming suddenly over the low bank of a tank I saw within a few yards of me a jaçana in some state of fear. Knowing that she had youngsters about I was quite prepared for her frightened cries, but not prepared to see her hurrying away across the matted weeds with a young one completely hidden under her left wing, except for its long legs which were dangling down. After a distance of some ten yards across the tank the bird opened her wing and let the nestling fall into an extra thick patch of weed and grass.

Is this the normal behaviour of the Jaçana family with their young when disturbed?

H. KINGSLEY KEFFORD,
F/Lt., 61082.

CUTTACK, ORISSA,
November 14, 1944.

15.—NOTE ON THE OCCURRENCE OF THE PINK-FOOTED SHEARWATER (*PUFFINUS C. CARNEIPES* GOULD) ON THE COAST OF CEYLON.

On June 26th this year one of us (Y.B.) picked up a dead Shearwater on the beach a quarter of a mile north of Mount Lavinia. It came ashore just at high tide and when found must just have reached shore, as the crows, large numbers of which frequent this beach in the monsoon, had not attacked it. It was brought home and submitted to careful investigation and identified as a Pink-footed Shearwater (*Puffinus c. carneipes* Gould). It had been dead at least 24 hours, probably longer. The plumage, however, though sodden, was complete but in moult and the coloration of the naked parts still recognizable. In the circumstances, it was decided to preserve the specimen complete rather than attempt to prepare a made-up skin. This was accordingly done in 10 per cent formalin in alcohol, after opening one eyeball to ascertain the colour of the iris, as this could not be determined on superficial examination.

The Pink-footed Shearwater has only been recorded once previously from waters around Ceylon. This was the specimen mentioned by Wait (1931) as having been picked up at Panadura, 17 miles south of Colombo in 1879, and which was identified at the British Museum. Identification of our present record has been assisted by consulting Wait and Alexander (1928) and we have no doubt of its correctness in view of the measurements and other characteristics detailed below.

Following is a brief account of the specimen:—

Measurements		*Sex*
		Male in non-breeding state
Total length	17·2″	
Wing length	12″	
Tail length	4·7″	
Tip of beak to angle of gape	2·2″	
Tarsus	2″	
Middle toe (without claw)	2·4″	

Plumage—

General colour sooty all over, feathers being blackish distally, but white near their shafts. There is little or no grey tinge ventrally, but there are some paler feathers on the throat.

Naked parts—

(*a*) *Bill:* Mainly pale flesh-colour, darker towards the tip. Lower mandible similar, dark grey at tip and along free edge. There is a median dark element dorsally and dark borders to upper mandible as well as dusky edges to nares.
(*b*) *Feet:* pink.
(*c*) *Iris:* Very dark brown, almost black.

This species appears to reside normally in the seas off Western Australia, but, like other shearwaters with restricted distribution, it occasionally gets carried by marine currents or weather beyond its normal range, and probably is more often carried in the direction of Ceylon than the two specimens so far known would indicate.

References—

Alexander, W. B., 1928, *Birds of the Ocean.*
Wait, W. E., 1931, *Birds of Ceylon*, 2nd edition.

W. C. OSMAN HILL, M.D., F.Z.S., etc.
AND
YVONNE BURN, F.Z.S.

COLOMBO,
July 16, 1944.

16.—WILD BIRDS AND THEIR CAPTIVE YOUNG.

Do parent birds poison their captive chicks? Common folk in some parts of Bengal believe that they do. A similar belief seems to prevail in the English countryside as E. D. Cumming suggests in his *Idlings in Arcadia.* He writes (p. 219), 'I once found a young blackbird ready to fly—his nestmates had flown—held fast by a strong thread of grass which by some means had laid firm hold of his foot; luckily for him it was too short to let him climb over the edge of the nest, but he must have starved—some people say been poisoned by the parents—had he not been rescued in time.' Douglas Dewar (Birds at the Nest, chap. v) cites many instances of young birds being left to their fate or evicted from the nest by their unfeeling parents. A few cases of young birds being done to death by one of the parents are also quoted by him as evidence of lack of parental affection. But Dewar's culprits all nested in aviaries and their method of infanticide lacked the refinement of practised poisoners. Dewar however illustrates the attitude of wild parents towards caged offspring in chapter vi of the book mentioned above. In the third week of May 1907, he placed three young sparrows in a cage. 'The parents fed all three, both bringing food until June 6th, when the hen ceased to do so apparently having gone to nest again. The cock sparrow continued to feed the young until June 26th.' This is obviously a case of simple desertion, but not of poisoning.

A case that smacks of Borgian methods is therefore well worth recording.

A friend of mine once removed four fledgelings of a Grey-headed Myna (*Sturnia malabarica*) from the nest hole. Not knowing how to feed them he decided to leave the task to the parents and placed the cage at a place where they could not help noticing it. For the first two weeks things went satisfactorily, but an old peasant who saw the birds feed the captive chicks shook his head doubtfully. They will poison the young ones, he confidently remarked and before long his prophecy came true. After three weeks or so the old birds began to bring lizards and other vermin, which if they were not actually poisonous were doubtless unwholesome as food and three of the chicks quickly expired. The fourth and last was then let loose but too late to be saved. I do not know whether it was a case of deliberate poisoning. The Grey-headed Myna cannot be expected to reason cogently and plan the death of their young ones to escape the labour of feeding them for an indefinite period. Dewar's sparrows simply shirked their duty and left the chicks. Did the Grey-headed Myna grow more careless about the choice of food as the parental instinct grew less urgent when the breeding season was nearing its close? In any case the popular belief is probably not entirely unfounded, and even if deliberate poisoning is ruled out as impossible, it is not unlikely that unwholesome food administered by parent birds sometimes expedites the end of captive chicks.

IMPERIAL RECORDS DEPT. S. N. SEN.
NEW DELHI,
September 19, 1944.

[It seems more likely that the chicks died of under feeding than through any 'unwholesomeness' of the food. Young birds have enormous appetites and it is reasonable to suppose that the parents were unable to satiate the caged chicks on account of their confinement. EDS.]

17.—THE BIRDS OF MYSORE.

In the 1943 December issue, *Scolopax rusticola*, the Woodcock, is described as a rare winter visitor. As to its being a winter visitor, yes, but personally, I should not call it rare, but then I may have been fortunate in my locality.

My estate is 3,600 ft. above sea level situated on the inner slopes of the Western Ghats, and during the last 20 years it is seldom that I have been unable to flush a cock between January and the full moon of April, from the cardamom ravines and small streams of the estate and the neighbouring jungle.

My observations go to show that they come in with the full moon of December and go out with that of April, there are certain favourite lies where I can invariably flush one, and not infrequently they are in pairs.

I have shot three in a morning, and I find that the weight is as a rule 21 oz, a good dog is most necessary as they sit very tight and once flushed are great runners.

A bird I have not seen mentioned is the 'Malay Bittern' *Gorsachius melanolophus*, the first one I saw and shot was in 1904, and at that time the Society did not possess a specimen, since then I have seen quite a few mainly in the bamboo jungle of the Bhadra Valley.

JAVALI P.O., R. G. FOSTER.
MYSORE STATE,
July 14th, 1944.

18.—ADDITIONS TO THE BIRDS OF BOMBAY AND SALSETTE AND NEIGHBOURHOOD.

The Large Gray Babbler : *Argya malcolmi* (Sykes).

A solitary bird was seen on top of Trombay Hill on 2nd August 1942—an obvious straggler. It is common in the Deccan though it has not been observed near Khandala.

[**The South Indian Black Bulbul;** *Microscelis psaroides ganeesa* (Sykes)

The Fauna records this species from Matheran, and Novarro and McCann have seen nests with eggs at Khandala in June and August. Local name 'gobhai'.]

The Gray-headed Flycatcher; *Culicicapa ceylonensis* sub sp.

Winter visitor. On 26th December 1941 H. A. obtained a specimen in heavy forest a few miles south of Kasa, in the Mahim District north of Wada. Another was obtained at Kihim, Kolaba district, on the same day the following year! Sálim Ali noted it on the same day the following year! Sálim Ali noted it at Mulund, Salsette, on 23rd December 1943.

The Grasshopper-Warbler: *Locustella naevia straminea* (Seebohm.)

This inveterate skulker was first noticed in tall dry grass on the borders of a swamp when snipe-shooting near Mumbra (11th Jan. 1943). We have subsequently met it on several occasions across the Harbour, at Powai and also at Lake Beale (Ghoti). A bird shot on 15th November was in general moult, wings, tail and body. It is apparently a fairly common winter visitor.

The Jungle Wren-Warbler: *Prinia s. sylvatica* (Jerdon.)

Several birds seen on scrub covered hills under Sāgardadh near Alibāg, April 24th, 1943. Almost certainly noted also at Surialmal on 1st June, 1941. Several seen at Shil, near Kalyan, 27 Jan. 1945.

Richard's Pipit: *Anthus richardi* (Vieillot.)

We shot a specimen (female) within 10 minutes of having obtained our first *Locustella naevia*, near Mumbra (11th Jan. 1942), wing 90 mm., tarsus 31 mm., hind toe 12 mm., hind claw 16.5 mm. Several were seen, and we subsequently got another at the Chembur-Katcherpatti on 25th January. It appears to be another regular winter visitor, so far overlooked. In the field it appears larger and darker than the other pipits. It frequents wet ground about snipe marshes etc.

The Green Munia: *Stictospiza formosa* (Latham)

A party of 4 apparently feeding on grass seeds was seen at Tansa Lake in September 1943.

[**The Belgaum Flowerpecker:** *Dicaeum concolor subflavum* (Stuart Baker)

Stuart Baker in *Nidification* (vol. iii, p. 243) refers to this species from Khandala and Mahableshwar, but the authorities and sources are not quoted.]

The Little Sunbird: *Leptocoma minima* (Sykes).

This is common at Khandala where it nests among the topmost leaves of *Strobilanthes* during March and April. A male was noted building (27th March 1944) at the top of *carwandah* bush just below Karnala Fort (Funnel Hill) across the harbour. We have also seen it at Bāwa Malang, Vajrabai and Suriamal, but not in Salsette Island.

The Malabar Black Woodpecker: *Macropicus javensis hodgsoni* (Jerdon).

This bird was seen at Suriamal on 1st June 1941 (*J.B.N.H.S.*, vol. xlii, p. 933).

The Red-winged Crested Cuckoo; *Clamator coromandus* (Linnaeus).

A bird flew into the Society's rooms on 7th November 1900 (*J.B.N.H.S.*, vol. xiii, p. 696). This bird was erroneously entered *C. jacobinus* in *J.B.N.H.S.*, vol. xl, p. 165.

The Sirkeer Cuckoo: *Taccocua leschenaulti* (Lesson).

On 21st June 1942, two birds were seen on a scrub-covered hillside with occasional trees on the mainland near Thana. Another turned up in a beat near the Vaiturna River near Khardi. Was also noted at Khandala on 22nd March 1943. The red beak and the white-bordered tail are distinctive.

The Crested Swift: *Hemiprocne coronata* (Tickell)

There is no record in Salsette Island but birds with flying young were observed (23rd April 1943) on a teak-covered hillside under Sāgargadh, near Alibag across the harbour. Other records are from Vajrabai Hot Springs (26th December, 1941, and 6th September, 1942), Khardi (8th March and 18th April, 1943), Mandwa on Wada Road (31 August 1941).

The Common Grey Hornbill; *Tockus birostris* Scop.

A single bird was seen at Powai Lake on 29th April 1945. The nearest record is from the Deccan, east of the ghats. The Malabar Grey Hornbill (*T. g. griseus*) is common at Khandala and has been seen in Salsette on several occasions.

The Mottled Wood Owl: *Strix ocellata* (Lesson).

We have no specimen, but have heard the eerie and distinctive 'chu-hoo-wah' at Elephanta (28th March 1942, Sálim Ali), at Khordi on the Vaiturna River (18th April 1943) and at Kihim (22nd April, 1943). Observed by S. A. in mango grove at base of Trombay Hill. The large amount of yellowish-buff on the wings is conspicuous in flight.

The Sind or Severtzof's Shikra; *Astur badius cenchroides* (Severtzof).

When examining some specimens in the Society's Collection together with Mr. H. G. Deignan, of the U.S. National Museum, we measured two females (Bombay City, 9th October 1906, Mr. Keyes; and Malad, Salsette, 17th November 1939, E. Henriques) as having wings of 223 mm. These measurements correspond with those of the Northern race, which may be a winter visitor to our area. Koelz measures 9 females from the Londa District as 199-209 mm.

The Indian Tawny Eagle : *Aquila rapax vindhiana* (Franklin).

This has been inadvertently omitted so far, though it is often seen during the cold weather when snipe-shooting. Powai, 24th Jan. 1942. Mulund 18th Jan. 1943. The beak is larger than in the pariah kite and shows more yellow at the gape. The rump is also paler and the tail rounder.

The Nilgiri Wood-pigeon : *Columba elphinstonii* (Sykes).

A single bird was seen at Matheran on 23rd April 1944. The black and white spots on the neck were prominent.

The Blue-breasted Quail : *Excalfactoria chinensis chinensis* (Linn.)

In Stray Feathers (Vol. x, p. 165) a specimen is recorded as obtained by Wenden at Vihar Lake, Salsette.

The Sanderling : (*Crocethia alba* (Pallas).

There is a specimen in St. Xavier's College marked 'Gorai', Salsette, 16th November 1936—G. Palacious.

The Indian Shag : *Phalacrocorax fuscicollis* (Stephen).

A solitary bird was seen in the large mixed colony of *P. niger* and *Bulbulcus* at Borivli on 25th August. It is distinctly large than *niger*, with a white throat and brown-speckled wings.

33, Pali Hill, Bandra, SĀLIM ALI,
Bombay. HUMAYUN ABDULALI

19.—NOTES ON INDIAN BIRDS—A CORRECTION.

E. H. N. Lowther in *J.B.N.H.S.*, vol. xliii, p. 389, in an article on Indian Hornbills, writes of and has excellent photographs of the Malabar Pied Hornbill.

This has, however, been referred to as *H. malabarica*. The key in the *Fauna* (vol. iv, p. 286) and the tails which are distinctly visible in the photographs show that the bird meant is *H. coronata.* Paradoxically, the trivial name of *H. malabarica* is the Large Indian Pied Hornbill.

This may perhaps merit an editorial correction in the Journal.

Messrs. Faiz & Co., HUMAYUN ABDULALI.
75, Abdulrehman St., Bombay, 3.
Bombay, *5th October,* 1944.

20.—ACCLIMATISATION OF MIRROR CARP IN THE NILGIRIS.

One aspect of inland fishery development in Madras is the introduction of improved varieties of exotic food fish. The following new kinds have been acclimatised and bred in the Presidency.

1. Trout (*Salmo iridens*) from England and New Zealand.
2. Common carp (*Cyprinus carpio*) from Europe.

3. Tench (*Tinca vulgaris*) from Europe.
4. Gourami (*Osphronemus goramy*) from Java and Mauritius.
5. Mirror carp (*Cyprinus carpio* var. *specularis*) from Prussia through Ceylon.

In this note a brief account of the Mirror Carp is given.

The Mirror Carp is a variety of the common European Carp. The difference between the two is in scaling. In the common carp, the body is uniformly covered with large scales of polygonal shape. The Mirror Carp has extraordinarily large scales of great reflective power which may cover the whole or part of the body.

The mouth of the Mirror Carp is relatively small and essentially suctorial. The jaws are devoid of teeth; but the pharyngeal bones are provided with teeth for purpose of crushing. The fish is omnivorous. Its food consists of insects, small crustaceans and molluscs, and vegetable matter. The latter makes up a large part of its diet. It obtains its food by rooting about in the mud like a pig, making the water turbid. By so doing, and by destroying the natural aquatic vegetation, it sometimes makes the waters where it is abundant unsuitable for other fishes. It is said that it not only feeds on the young and eggs of game fishes, but also attacks wild fowl.

The Mirror Carp thrives well in higher altitudes. It can be acclimatised even to lower elevations of 2000 to 3000 feet, but gets stunted in growth. It prefers quiet, weed-grown waters, but can also live in rather swiftly flowing streams. If kept in small ponds the fish has to be fed on earthworms, bread, or rice, but if in large reservoirs or rivers, it does not require any artificial food.

The fish breeds prolifically, spawning taking placing during the cold months. The eggs are deposited among vegetation. In the absence of weeds, the eggs fall into the mud, and die.

The Mirror Carp is said to grow to three feet in length, and 60 lbs. in weight. It is valued as an excellent food fish, but not as a sporting fish. It is tenacious of life and will live out of water a considerable time, and hence may easily be marketed.

The fish was first introduced into Ceylon from Prussia in 1914 by the Ceylon Fishing Club. They averaged about 6 inches in length when introduced and speedily grew in the Hatchery Ponds in Nuwara Eliya, but though kept there for some years did not breed. To encourage them to breed they were removed to Abbotsford Estate at a lower elevation and kept in an open pond, again with no success, though they attained 5 to 6 lbs. in weight. Finally they were returned to Nuwara Eliya and turned into a large pond in the Park, where, due to the presence of a plentiful supply of water lilies which provide breeding facilities, they bred and have continued to breed ever since. Mirror Carp were also successfully introduced into the Hatton District at an elevation of 4,200 ft. and have bred there. In Ceylon they have grown to a weight of from 30 to 40 pounds in the Nuwara Eliya Lake.[1]

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[1] These details were kindly furnished by Mr. Phillip Fowke, Secretary, Ceylon Fishing Club.

Owing to their large size, rapid growth, and prolific reproduction, coupled with their resistance to drought and ability to sustain life in the most barren ponds, Mirror Carp are a highly suitable food fish for culture in South Indian hill waters. In January 1939, fifty-five Mirror Carp fingerlings, ranging in size from 6 to 8 inches were successfully transported from Ceylon and planted in the Crescentic pond in the Government Botanical Gardens, Ootacamund (7,000 ft.). Though the Crescentic pond is small and only 3 ft. in depth, the fish thrived very well and bred in the beginning of 1942, after an interval of exactly three years. The adult fish measured 2 feet, thus showing a rate of growth of 6 inches per year. Nearly 1,000 fingerlings, measuring 3 to 6 inches in size were found in the pond in May 1942.

The fact that the fish had outgrown the Crescentic pond, necessitated the transfer of some of the adults and fingerlings in 1942 to a more suitable and larger pond in Sim's Park, Coonoor. In this pond also the fish bred, and thrived well showing a rate of growth of 4 to 6 inches in six months. Many fingerlings were stocked in the Ooty Lake in 1943. The fisheries of the lake are now protected and regulated by the issue of licences for angling only. The Ralliah Reservoir, which is the main water supply to the Coonoor town, was also stocked with fingerlings of this fish.

It has clearly been established that the Nilgiris suits the Mirror Carp. If lakes, ponds, and streams in the hilly regions of this Presidency are stocked with Mirror Carp, a new and good source of food fish can be made available to the population. It is, therefore, proposed to stock the Lovedale Lake (Nilgiris), Yercaud Reservoir (Shevaroy Hills), Kodaikanal Lake (Palni Hills) and other suitable hill waters with this fish. As a preliminary to this, the construction of a fish farm at Ooty for large scale culture of Mirror Carp is under the consideration of the Department. The ultimate aim is to place the fish in the markets of Ooty, Coonoor and other towns in the hills.

Experiments are being conducted to acclimatise Mirror Carp on the plains. In February 1943, fifty fingerlings, ranging in size from 5 to 13 inches, were successfully transported and stocked in a pond in the Thandipandal Fish Farm in the Kambakkam Forest area (Chingleput District), situated at an elevation of only 500 ft. The fish are thriving well, though the rate of growth is only 3 to 4 inches per year.

Fingerlings of Mirror Carp are now available with the Department for supply to those interested in their culture, at a cost of Rs. 10 per dozen.

DEPARTMENT OF INDUSTRIES AND COMMERCE,
CHEPAUK, MADRAS,
September 15, 1944.

P. I. CHACKO, B.A., B.SC.(Hons.), F.Z.S.,
Assistant Director of Fisheries
(Inland Development).

References—

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21.—NOTE ON THE FOOD OF TIGER SHARKS (*GALEOCERDO* SSP.) OF THE MADRAS COASTS.

'All is grist to their mill': it seems their ravenous appetite incites them to snap at or swallow whole' all kinds of objects; they are said to bite dangling and protruding objects and seem to be easily attracted by white ones. This particular habit causes the attacks on human beings by these sharks. The presence of a stray shark in a pearl bed induces so much of fear in the minds of the pearl divers that they refuse to dive and sometimes the fishery itself comes to a sudden end. But these are all items which are not part of the diet of the Tiger Shark.

During the investigations on the shark fisheries of the Madras Presidency, a large number of specimens of Tiger Sharks (*Galeocerdo articus* and *G.rayneri*) were examined. The stomach contents included the following different kinds of food-fishes in the different areas: mackerel, seer, soles, silver-bellies, cat-fish, horse-mackerel, small sharks, skates and cuttle-fish on the Malabar and S. Kanara Coast; cat-fish, ribbon-fish and anchovies on the Vizagapatam Coast; and flying fish, hilsa, horse-mackerels, silver bellies, small sharks, small saw-fish in the Tanjore, Ramnad and Tinnevelly Coasts.

Besides the above economically important food-fishes, turtles and sea-snakes have been common items in their diet. Sea-snakes have been observed in the stomach contents of Tiger Sharks captured on both the coasts.

It may not be out of place here to mention a few of the interesting objects which some of these sharks have swallowed. A non-gravid female *G. articus*, measuring 11 ft. in length, and caught off Tellicherry on 28th June 1943, had the head of a cow in its stomach. A 10 ft. male, caught off Pudimadakka in Vizagapatam Coast, on 12th January, 1944, had swallowed two biscuit tins. A male tiger shark, measuring 5 ft. in length and caught off Lawson's Bay on the same Coast on 11th January, 1944, had devoured a goat, and another male, 8 ft. long, had gulped in a bag containing 10 lbs. of raw rice!

WEST HILL,
MADRAS.
September 11th, 1944.

K. CHIDAMBARAM,
Assistant Director of Fisheries,
(Marine Biology).

22.—EGG-LAYING OF THE COMMON 'BLOODSUCKER' (*CALOTES VERSICOLOR*).

The terrain is a two or three miles wide coastal strip of sand

The female lived outside the door of the company office (a calaboose hut) and was quite well known to the persons therein. In the afternoon of 11th August, 1944. she was observed to be wandering in a somewhat agitated manner. Having selected a spot she made a few tentative scratches with her forelegs. Then after a moment she began to dig in earnest. At first the digging was done without looking at the ground. The digging was accomplished by several strokes of a forelimb to lift the sand and then a stroke of the hind limb on the same side to remove the sand dislodged, and so on alternately.

When the hole had progressed some way the lizard lowered the forepart of her body into it. She then proceeded with alternate fore and hind leg strokes, a few on each side, and then a change over. This was broken by pauses from time to time. After about three quarters of an hour the hole was complete. Its depth was equal to the snout to vent length of the lizard, about 100 mm. It was about 25 mm. wide.

She now straddled the hole resting on the forelegs and tail. The hindlegs hung down the hole and did not appear to be serving to support the body in any way. She was now facing in the opposite direction to that taken up when digging. After a pause the egg laying commenced. Fourteen eggs were laid at irregular intervals varying from a few seconds to about half a minute. It was completed in about a quarter of an hour.

When all the eggs were laid she turned round and began tamping with her nose. Then she straddled the hole, and using the forefeet scraped sand back into the hole and then tamped with the nose, and so several times alternately. Between the spaces of scraping and tamping she took short rests. After three such spells she turned to her left though about a right angle. Straddling the hole she arched her back and raised and lowered the body several times on the forelegs. It appeared to be an attitude of considerable strain. Then the filling continued. The forelegs were used a few strokes each alternately. As the filling proceeded she began to turn in various directions to scrape sand. During this stage the hind legs were used on one occasion to make a few strokes in an obliquely forward direction.

When the hole was full, the lizard continued to scrape and tamp the surface for about five minutes before she eventually came to an end and departed.

The site chosen was in the very doorway of the company office.

This account is written from the observation of several witnesses besides myself.

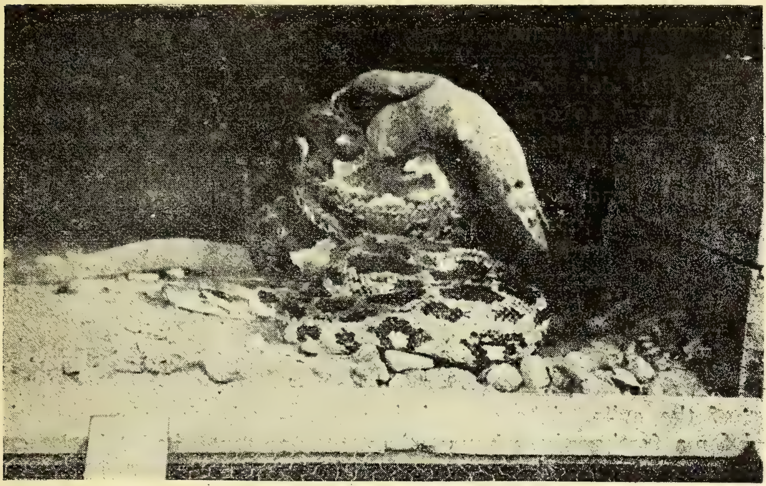
The only important respect in which it differs from Asana's account is in the use of the hind legs.

c/o 30. A.B.P.O.
INDIA COMMAND,
August 30th, 1944.

G. L. UNDERWOOD.

23.—INDIAN PYTHON (*PYTHON MOLURUS*) PREYING ON MONITOR LIZARD (*VARANUS MONITOR*)

The following account of an unusual occurrence concerning the feeding habits of *Python molurus* in captivity is submitted, along with the accompanying photographs, as evidence of a peculiar action by a specimen held in captivity by the writer.



The Indian Python (*Python molurus*).

On the 15th October, 1944, a fine example of the monitor lizard (*Varanus monitor*) was captured and presented to me by a colleague. It measured 4 ft. in length and to prevent escape a rope had been fastened round the posterior of its belly just above the hind legs.

At the time of the presentation, the only available accommodation was a large vivarium already inhabited by an 8 ft. 6 inches. Indian Python (*Python molurus*) and it was decided, pending the construction of an additional box, to allow the monitor to share the snake's dwelling place. Here it must be borne in mind, to justify the writer's action in confining the two specimens to the one vivarium, that throughout the past year the python had been feeding exclusively on house rats. Further with the advent of the cold weather the snake had already been showing the usual signs of lethargy prior to the commencement of the hibernation period.

To obviate any immediate friction between the two reptiles the monitor was slowly allowed to enter the cage by a restraining grip being kept on the rope. Unfortunately, it began to burrow in a corner amongst the soft earth, using its extremely long claws to remove the soil.

Up till then the snake did not appear to have noticed the entrance of the newcomer and it was not until one of the monitor's claws inadvertently scratched the scales of the python that the latter proceeded to exhibit any signs of interest. Upon realising the presence and close proximity of the intruder, the python struck with the speed and accuracy typical of its genus, instantaneously enveloping the monitor with all its coils. It must be explained that whereas an unsuccessful attempt was made by the writer to separate the reptiles following this catastrophe, it was decided to follow the line of better judgement and refrain from interfering for fear of putting the python off its food.

Although the lizard's head, neck, and forelimbs were free from the coils, it appeared unable to use any of these members as a means of defence—probably due to the fact that its ribs were distinctly heard to crack a few seconds after the initial constriction—and seemed passively resigned to its fate. It did, however, exhibit a tenacious hold on life and managed to survive for an hour and a quarter before dying; the pressure at that period from the coils being extremely powerful. The time was then 6-30 p.m. and all credit is due to my colleague, Mr. R. M. Rogers, in obtaining the two excellent photographs during the failing light and under difficult conditions.

It was just previous to the photographs being taken that the snake decided to remove its jaws from the hind leg of its victim. This was achieved with much difficulty owing to the extreme tightness of the coils. The constricting process, however, was continued for a further three hours when, at 9-30 pm., the snake began to swallow the lizard.

Contrary to expectations this latter operation proved an easy one for the python; the whole four feet of the monitor, plus the length of thick rope still attached to its body, disappearing within ten minutes.

The bulge inside the python was visible for 48 hours and the first discharge of excreta made its appearance on the 22nd October, seven days after the consumption. This was composed entirely of chalk. A further discharge was noted on the 1st November, seventeen days after the swallowing and upon examination was found to contain the claws, teeth and rope lead intact with the knot still tied. The remainder of the matter was indiscernible.

As I am not in a position at the present time to consult past volumes of the *J.B.N.H.S.* as works of reference, I would welcome any comments by members of the Society on these observations as I am under the impression, from past studies of the species *Python molurus,* that it has been generally assumed that its food consists almost entirely of mammals and birds. In which case I must point out that whereas the specimen referred to in these notes may be excused the initial instinctive attack on the monitor on the grounds of provocation, it had four hours in which to investigate its kill and that the swallowing action was nothing less than deliberate and without hesitation.

ALLAHABAD, P. MASH.
November 6, 1944.

24.—NOTES ON A RARE AND INTERESTING NARROW-MOUTHED FROG, *UPERODON GLOBULOSUM* (GÜNTHER).[1]

With a view to collecting termite queens from a termitarium, my colleague, Prof. D. Mukerji with two post-graduate pupils, Messrs. S. H. Hazarika and P. K. Mitra of this department, went to Belghurria (Bengal), some eight miles north of Calcutta on the 27th August, 1944. A termitary was found in the vicinity of the railway station. It was nearly six feet high from the ground. In course of excavating the mound for termites, two specimens of a burrowing frog were exhumed from a depth of about a couple of feet from the ground-level. As the nest was highly infested with snakes, further excavation was not attempted. Mr. Mukerji recognized the frogs as rare and interesting forms, and kindly presented them to me for study. I am greatly indebted to him for this gift and I heartily thank him.

The two specimens were brought to the laboratory and kept separately in cages filled with earth. They were in the cages for two days, but to my great surprise and chagrin, I found one of them missing after the third night. I am deeply mortified to lose this rare frog. In the hope of getting a few, at least one more specimen, of this uncommon frog, I, accompanied by Mr. Hazarika, visited the place of occurrence next week on September 3, 1944. But, as ill-luck would have it, my search for it was fruitless, although much of that broken termitary was thoroughly dug out.

Its tiny head with dark bead-like eyes is so characteristic that I had no difficulty in identifying this frog *Uperodon globulosum* (Günther), especially from the viewpoint of its orbital diameter which is greatly reduced in comparison with that of its only congener *U. systoma* (Schneider) (*vide* Mukerji, 1931, p. 98, footnote 2). It may also be recalled that I was a personal witness to Mukerji's (1931) fasting experiment of this frog at the laboratory of the Zoological Survey of India. Prior to Parker's publication of the monograph on the Microhylidae in 1934, these frogs were usually referred to the genus *Cacopus*.

It is well known that *U. systoma* is fairly widely distributed in India and Ceylon, and very common in certain areas of South India (Ferguson, 1904, p. 507; Rao, 1918, p. 45). Having obtained two specimens of *Uperadon* (sic) *systoma* at Agra, Mahendra (1939) has recently extended its northern range to the United Provinces. But attention may be drawn to the fact that as late as 1871, Anderson in the list of 'Batrachia Salientia' in the Indian Museum, had entered 11 specimens from Agra under '*Caçopus systoma*'. I think that this species may not be uncommon in Bengal, although I have not been able to obtain a single specimen so far.[1]

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[1] Two popular English vernacular names 'frog' and 'toad' are available for referring to *Salientian Amphibia.* Authors, however, do not use these terms discriminatingly. Devanesen (1922) and Mukerji (1931) call this form a 'toad'. As it belongs to *Microhylidae*—an allied family to *Ranidae,* I have preferred to call it a frog (*Sensu* Parker, 1934).

A reference to Mukerji's paper (1931) will make the rarity of *U. globulosum* quite evident. He notes that only 10 specimens have been reported from India and Ceylon, four specimens including two types being preserved in the British Museum (Nat. Hist.). Out of these four specimens, Parker (1934) considers the juvenile cotype to belong to *U. systoma;* he also relegates Pearson's record of this species from Ceylon to the synonymy of the same. Thus the number of specimens recorded so far has been reduced to 8 only. Bengal records of *U. globulosum* are only two, one from Sibpore Botanical Gardens (Anderson, 1871) and the other from Khardah (*vide* Mukerji, 1934). Now to this list of eight specimens is added the one obtained from Belghurria (the other specimen being lost is not computed here). Further, I take this opportunity to add one more pickled frog of this species which I have recently obtained from Mr. N. K. Mitra, B.Sc., Curator of the Herbarium, who collected it from the Sibpore Botanical Gardens, near Calcutta. This is, therefore, the second specimen obtained from this area after Anderson's record in 1871. The specimen is without any apparent history. It is a juvenile female specimen, measuring 35.5 mm. from tip of snout to vent, and is slightly mutilated on the pelvis. My hearty thanks are also due to Mr. Mitra for the presentation of this rare frog. Thus the number 10, as recorded by Mukerji (1931), is restored.

It may be observed that from the point of view of locality records, *U. globulosum* also enjoys a somewhat wide distribution, it being found in the Madras Presidency, Central Provinces and Bengal, although numerical records from these areas are few and far between. All the same it may be presumed that it is not so common as its ally *systoma* in any of these areas. Why this is so remains a mystery. Can it be for lack of assiduous search? Probably its great fossorial habits and subterranean habitat have enabled it to elude the alert herpetological detectives.

I am not aware whether there is any male specimen of *U. globulosum* on record; at least, I do not find it definitely mentioned in Mukerji's paper (*loc. cit.*), nor was it noted in Parker's monograph. It may be mentioned here that the specimen which escaped from my cage was undoubtedly a male one, as was evidenced by the presence of black pigmented skin on the throat such as is found in *U. systoma* (Parker, 1934). Before I lost it, however, I had examined its fingers and found no nuptial excrescences for grasping, nor could I hear its croaking. It was almost identical in size with the other one which measures 54.0 mm. The present specimen also shows faint but clear dusky skin under the throat, simulating a male sex. I thought it was not a male. As there was no other secondary sex character, I could not determine its sex till I dissected it. A non-pigmented internal subgular vocal sac, which does not appear to be well developed, is observed under the dusky throat skin, as also the highly pigmented testes. The vocal sac openings in the buccal cavity are two in number. They are slit-like and situated obliquely along the outer edges of the extrahyals of the hyoid apparatus slightly hidden by the thick fleshy tongue. Further, the 'linea masculina' which is said to be present in the males of majority of Salientian species (Liu, 1935) is also observed in *U. globulosum*. It is a whitish band, about 2 mm. in diameter, extending along each side of the ventral abdominal muscles and bifurcating into two in the pectoral region. There is also a double line of such bands at the back on each side of the vertebral axis. This is the first male specimen of *U. globulosum* which has ever been recorded.

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[1] Subsequently, on enquiry (*in literis*) I have come to learn from Dr. B. N. Chopra, Offg. Director, Zoological Survey of India, that there is no specimen of this species recorded from Bengal in the collections of the Indian Museum, and that only eight specimens of this frog from Agra, presented by Anderson, are mentioned in the official record.

Much speculation has raged over the remarkable rotund or globular shape of *Uperodon* (Devanesen, 1922). My observations on the present specimen, however, fully bear out Mukerji's main contention that the globular shape of its body is chiefly, if not entirely, due to the distension of the body-cavity caused by the inflation of the lungs which are also capable of swelling up dorsally in the form of oval pouches on the two sides of the vertebral axis (*vide* Mukerji, 1931, p. 100, and pl. I, figs. 2 and 3).

Further, it may be observed that when I threw it into a big glass jar containing water, it became very uncomfortable there. It never dived to the bottom of its own accord when disturbed, as some frogs and toads often do, but attempted in vain to come out of the water. It then floated keeping its fully distended body with its outstretched limbs parallel with the surface of the water. Instead of using the short-webbed toes for floating, its lungs were called into play for hydrostatic function.

It is interesting to note that when thrown to the hard ground, this frog is deliberate in its movements, and prefers walking and running to hopping which it can do a little. It cannot leap to any extent at all; probably the length of its legs is against leaping.

I have nothing to add to Mukerji's (1931) admirable and precise description of the burrowing habits. It may be noted that in sticky and clayey soil it leaves a wide hole on the surface presumably for the purpose of ventilating its burrow. In loose soil no surface holes were observed.

The coloration of the living specimen exhibited a uniform brownish dorsum with little dingy white spots sprinkled on the flanks and on the upper surfaces of the fore- and hind-limbs. It also exhibited nice dashes of yellow patches extending from the sides to the creamy white underparts. These yellow patches, however, disappeared on preservation. The specimen which escaped had a slightly greenish ground tone on the dorsum. The pickled specimen is more brownish with pale white spots as noted above. Coloration on the whole is unimpressive.

The skin appeared to be thin and almost smooth when the body was fully inflated. On close examination a few dorsal tubercles are evident, but they are by no means prominent. Exudation of slime secretion was observed when it was kept in the open air as noted by Mukerji (1931). With a view to doing some anatomical works I chloroformed it on the fourth day of its captivity. When it was being chloroformed, a copious flow of yellow exudation was given out from the dorsal skin. On examination it was found to be very sticky, more sticky than any I have so far seen of such frogs (*Rana*) and toads (*Bufo*) as are commonly available in Calcutta. The sticky yellow exudation is slightly soluble in hot water, it contains sugar and traces of protein. I am indebted to my colleague, Dr. S. M. Sircar, of the Botany Department, for this little piece of chemical information. I do not find any deposit of fat under the skin worthy of mention.

Nothing is on record regarding the life history of *U. globulosum* or its mysterious habits and underground life.

Measurements in millimetres of some of the body parts of the two specimens

	1 ♂	2 ♀
Tip of snout to vent	54·0	35·5
Breadth of head	16·6	11·0
Eye (orbital diameter)	3·6	2·6
Snout	3·2	2·4
Orbital end to tip of snout	7·0	4·5
Upper eyelid	2·2	1·6
Interorbital width	7·7	5·0
Inner metatarsal tubercle	5·2	3·5
Outer metatarsal tubercle	2·7	2·0
Tibia	19·0	12·5

1. Belghurria: 2. Sibpore Botanical Gardens, near Calcutta.

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September 18, 1944.

JNANENDRA LAL BHADURI.

25.—*CATOPSILIA CROCALE* BREEDING WITH *CATOPSILIA POMONA*.

Yesterday I took a pair of *Catopsilia* in the act of mating. The male was flying strongly with the inactive female firmly attached. On examination the male was found to be a normal *Catopsilia crocale*, Cr. but the female was an unusually coloured *Catopsilia pomona, F.* This female carried all the normal *pomona* markings, dark brown apex up with inwardly dentate margin, post-discal band and spot end cell, but the ground colour above was greenish white with lemon-yellow base H, *pomona* male. The resulting effect gave the impression of a female *Catopsilia crocale*. Would it be that the male was deceived, as I was at first, that here was a female of his own species? I understood that a butterfly is incapable of distinguishing colour differences, but there appears to be no other obvious reason for the mistake. Is it possible for any fertile ova to be deposited as a result of this irregular union? The specimens are available if anyone is interested in examining them.

JUBBULPORE, JOHN C. GLADMAN,
July 23rd, 1944. *Major*.

26.—SAP DRINKING BUTTERFLIES.

I read with interest the paper on Sap-drinking butterflies by M. Suter, D.Sc., in the *Journal* for April 1944, and I would like to add my own observations to his.

The scene of most of these observations was a small clearing in a patch of light mixed jungle crowning a small ridge of ground some four miles from Jubbulpore. In the centre of the clearing was a recently hewn tree stump, four feet high, from which a light sap was pouring in a steady stream. I was able to keep this clearing under observation at intervals over the period mid-February to mid-March by which time the sap had ceased to flow.

The following butterflies were observed to partake of the sap, the list being in order of frequency:—

Mycalesis mineus polydecta, Cr.
Euthalia nais, Forst.
Mycalesis perseus typhlus, Fruh.
Melanitis leda ismene, Cr.
Charaxes fabius fabius, F.
Eriboea athamas agrarius, Swin.
Charaxes polyxena imna, But.

The last three butterflies are not at all common in this area, the single *imna* that appeared, a male, being one of the only two I have seen in some eight months in Jubbulpore. *Lethe rohria nilgiriensis*, although common in the locality was never observed to venture out into the open to reach the sap, preferring to keep to the bases of trees well covered with undergrowth or young shoots.

The browns I found rather shy, retreating to the nearest cover at my approach, but reappearing to feed within a minute or two if there was no further disturbance. The other species seemed to be more concerned with the quantity of sap they could absorb than with the approach of any enemy. A *Charaxes fabius* and an *Eriboea athamas*, feeding so close together that they appeared to be a single insect with a symmetric wings, were taken after feeding continuously for at least ten minutes. Their bodies were swollen to an inordinate size with quantity of fluid imbibed.

No enemies, myself excluded, appeared to prey upon the feeding insects. In fact the only bird I have seen in this wood was a Pied Crested Cuckoo towards the end of June, which is probably the reason why this patch of jungle is favoured by so many butterflies. I have taken specimens of 45 different species in this wood alone and it is barely 500 yards by 100 yards in extent.

In general I found that the two species of *Mycalesis* listed, together with *Euthalia nais* feed throughout the day, *Melanitis leda ismene* from 3 to 4 p.m. onwards, while the *Charaxes* and *Eriboes* arrived to feed about 3 p.m. prefacing their meal with a circular tour of the tree-tops which might commence as early as midday.

I have also on single occasions noted *Kallima inachus huegli* taking sap at Pachmarhi, C.P.S., and at Kathgodam at the foot of the Kumaon Hills, both towards the end of the day, around 6 p.m.

JUBBULPORE, JOHN C. GLADMAN,
July 23rd, 1944. *Major.*

27.—ADDITIONS TO THE LIST OF SIMLA BUTTERFLIES PUBLISHED IN VOL. XLI, No. 4.

287. **Melanitis zitenius zitenius** Herbst.

Jesus and Mary Nullah, Simla at 7,000 feet on May 29, 1939, and Simla at 6,000 feet on May 26, 1941.

288. **Pathysa nomius nomius** Esp.

Chota Simla P. O. garden, 1944. A remarkable extension of range.

289. **Telchinia violae** Fab.

Two, Bishop Cotton Preparatory School, 1944.

290. **Tajuria illurgioides** De N.

Simla, 1944.

291. **Pedestes masuriensis** De N.

Simla, 1944. The two last species were recorded by Mr. Temple who has a remarkable flair for finding unusual and rare butterflies in the Simla district. For reference I give below a summary of new species recorded in the Simla Hills and their immediate interior since the publication of the list in 1940.

279. **Papilio machaon asiatica** v. **ladakensis**, M.

Poo, July, '41. Rare.

280. **Parnassius simo** Simo. Grey.

Shipki Distt., July, 1940. Very rare.

281. **Parnassius delphius (stenosemus ?).**

A fine series from the Shirang La in July of 1940. In all probability a distinct subspecies.

282. **Baltia butleri butleri** M.
Not rare in the Shipki Distt. In July.

283. **Venessa ladakensis,** M.
We have a few specimens from the Shipki Distt. taken in July.

284. **Polyommatus vicrama vicrama** M.
Puri. Not rare in July and probably not rare in Shipki Distt.

285. **Ismene aedipodea aegina** Plotz.
Simla, Spring, 1942. Very rare and an extension of range.

286. **Hesperia alpina alpina** Erach.
Shipki Distt. Apparently not rare in July.

Note :—

77. **Maniola lupinus cheena** M.
There are apparently no definite records of the appearance of this butterfly in the Simla Hills. Nevertheless it is almost certain to be found in the inner ranges as it has been recorded both to the east and west.

KETTI, NILGIRIS, M. A. WYNTER BLYTH,
October 17th, 1944. *M. A. (Cantab)*

28.—DESCRIPTION OF A NEW DIMORPHIC FEMALE OF *EURIPUS CONSIMILIS CONSIMILIS* WD.

Caught at Thaton, S. Burma, slightly above sea-level, March 1927. *Description*: Expanse: 80 mm's. Sex:

Conforming to the characteristics of the genus *Euripus*, identified as *consimilis* as the bast of underside of the hindwing is carmine in colour. *Shape*: Similar to that of *consimilis* ♂ except that the wings are slightly more rounded in outline. *Upper forewing*: black-brown, glossed purplish. The apical 2/5 is very lightly powdered with whitish blue scales in faint streaks. There is an oblique black bar across the middle of the cell and another one closing it. These are but faintly visible and are similar in shape and position to those on *consimilis*. There are obsolescent white sub-marginal spots—two in 1b, one in 2 and 3, and the trace of a second in 3. In addition there are a pair of small marginal spots on either side of veins 2 and 3, two minute ones in interspace 1b and traces of one in 1a. There is a pronounced fold in the wing between veins 1 and 2. *Upper hindwing*: black-brown, faintly glossed with purple. Deeper black along the veins. Largish sub-triangular submarginal spots in terspaces 1c to 6, that in 6 being smaller than the others and the inner half of the spot in 1c being extended to the margin. A dorsal white patch in 1b and two small marginal spots in each interspaces from 1b to 7. *Under forewing*: brown, spotting as on forewing. 1a and the basal 2/3 of 1b. basal 1/3 of 2 and the lower $\frac{1}{2}$ of cell, glossed blackish-purple. *Under hindwing*: lightish-brown, spotted as on the upperside. Basal area carmine. *Body*: abdominal segments divided by yellowish lines beneath. Otherwise the body and head are similar to those of consimilis ♂.

As the above specimen is not unlike E. *halitherses* ♀ v. *cinna-*

moneus it seems reasonable to suppose that *E. consimilis* may have a similar dimorphic form.

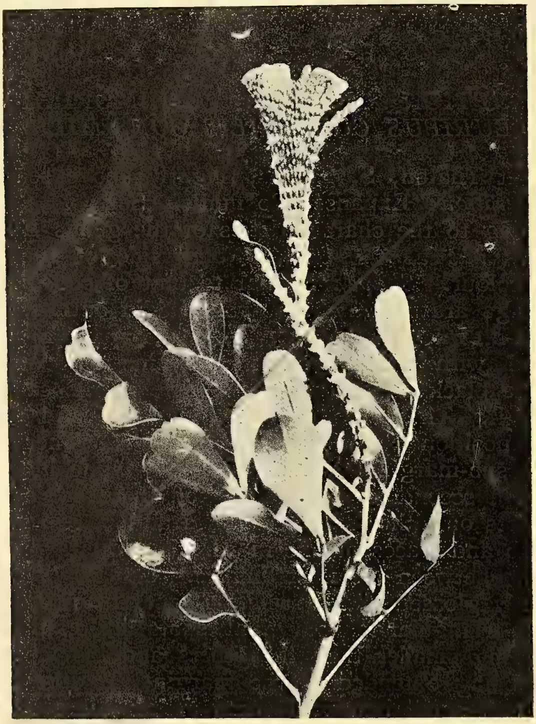
May I put forward the name *consimilis* ♀ its captor.

KETTI, NILGIRIS, M. A. WYNTER-BLYTH,
October 17, 1944. M.A. Cantab.

29.—FASCIATED INFLORESCENCE OF *SOPHORA SECUNDIFLORA* DC.

(*With a photo*).

Examples of fasciation are not rare among flowering plants but when it is developed in an unusual way its description with illustrations often proves very interesting—as the unusual and bizarre always does. Fasciation in plants and comparable manifestations of the abnormal development of tissue in animals present one of the most bewildering problems which engage the attention of the biologist. Perhaps the plant physiologist and the pathologist do not worry so much about this subject for fasciation is an unimportant malady, indeed it is practically unknown among the most important economic crops. To the pathologist concerned with animal diseases, however, development of abnormal tissue is a subject of very serious thought and attention. The problem



FASCIATED INFLORESCENCE OF *sophora secundiflora* unfortunately is extremely difficult of solution, for it is associated with the fundamental principles of cell division and increase, a subject about which we as yet possess very little knowledge.

The abnormal condition in plants described as fasciation, is first induced by irritation of some kind; it may be friction between the soil particles and the young, soft stem as the latter is emerging and pushing through the soil to the light, or it may be brought about by the attack of some pest or disease. The reason why phenomenon of fasciation is so common in *Asparagus* and many species of Lily is that these have to force a very thick stem through a medium of often unyielding nature.

Fasciation is of rare occurrence in seedlings or in herbaceous plants in which the young stem tip is formed to a spear-like point. In cases where the abnormality is associated with a pest or disease, it spreads from the point of attack. It is said that the abnormal growths are attempts by the plant to throw off the invader but there is nothing to substantiate this idea. The original point of 'infection may be only a very minute portion of the plant's surface, but the abnormal activity which the affected cells develop spreads to other parts of the plant, leading to more or less widespread twisting and malformation of subsequent growth. What appearance the plant may ultimately assume is incidental and rests on which particular group of tissues finally become involved. Strangely enough, fasciation does not interfere with the normal functioning of affected tissue, although the plant may succumb from the attack of the agency which caused it.

Recently an interesting case of fasciation of an inflorescence in *Sophora secundiflora* Dc. was detected by the writer in the grounds of the Forest Research Institute, Dehra Dun, on the 5th July, 1944. This plant is a free flowering ornamental evergreen shrub or small tree belonging to the family Papilionaceae. It is indigenous to the Southern United States and North Mexico, and is also frequently cultivated in gardens in the plains of Northern India. Normally the fragrant pale violet-blue flowers are borne in dense terminal drooping racemes which are 3-5 in. long.

In the accompanying photograph can be seen one ordinary raceme and another which exhibits extreme fasciations in that the nodes of the shoot have apparently become suppressed and the racemes all arise at one point, finally becoming fused together in a flattend fan-like structure which is about 4 in. long and 1.2 in. broad at the apex.

FOREST RESEARCH INSTITUTE, M. B. RAIZADA.
DEHRA DUN, *Ag. Forest Botanist.*
September 29th, 1944.

30.—NOTE ON SOME GRASSES FROM JUNAGADH.

The monumental monograph on the *Bombay Grasses*[1] contains descriptions of 319 species belonging to 110 genera. Of these only 36 species belonging to 27 genera are recorded from different localities in Kathiawar, such as Junagadh, Porbandar, Rajkot, Morvi, Dwarka, etc. Kathiawar which has an area of about 23,500 sq. miles, has remained the least explored part of the Presidency as regards its flora. The Province has not been systematically worked and data relative to the species which occur and the distribution are incomplete and inadequate. Only 8 species belonging to 7 genera are recorded from Junagadh. They are indicated in my list by an asterisk mark. I have adopted the arrangement and nomenclature followed in the *Bombay Grasses* which must remain the standard work for botanists of this Presidency for many years to come. References are also given to Cooke[2] and Watt[3]. The local vernacular names of some plants are given but not much reliance should be placed on them. Cultivated species are excluded from the list.

1. **Coix Lachryma-Jobi,** Linn. Bomb. Gr. 3; Fl. Bomb. II, 997.

Coix Lachryma Linn. Watt. Dict. Econ. Prod. Vol. 2 p. 492.
Vern. *Kans; Kassai.*

*2. **Polytoca Cookei,** Stapf. Bomb. Gr. 5; Fl. Bomb. II, 998.

*3. **Polytoca barbata,** Stapf. Bomb. Gr. 6; Fl. Bomb. II, 999.

Vern. *Gharolum.*

4. **Ischaemum rugosum,** Salisb. Bomb. Gr. 12; Fl. Bomb. II, 959; Watt Dict. Econ. Prod. Vol. 4. p. 531.

Vern. *Gundaran;* Chharo.

5. **Ischaemum pilosum,** Hack. Bomb. Gr. 14; Fl. Bomb. II, 961; Watt. Dict. Econ. Prod. Vol. 4, p. 531.

Vern. *Khev; Khevdo.*

6. **Sehima nervosum,** Stapf. Bomb. Gr. 21.

Ischaemum laxum, Br. Fl. Bomb. II, 964 (partim). Watt. Dict. Econ. Prod. Vol. 4, p. 531.
Vern. *Saniyar.*

7. **Apluda varia, Hack. var. aristata.** Hack. Bomb. Gr. 29; Fl. Bomb. II. 956.
Opluda artistata, Linn. Watt. Dict. Econ. Prod. Vol. I, p. 272.
Vern. *Bhangoru; Fofli; Karedi.*

8. **Sorghum halepense,** Pers. Bomb. Gr. 55; Watt. Dict, Econ, Prod. Vol. 6 Pt. 3, p. 280.

Andropogon halepensis, Brot. Fl. Bomb. II, 983.
Vern. *Baru; Boru; Baruva.*

9. **Chrysopogon montanus,** Trin. Bomb. Gr. 70.

Andropogon Monticola, Schult. Fl. Bomb. II, 985.
Vern. *Gadnelun.*

10. **Dichanthium annulatum,** Stapf. Bomb. Gr. 94.

Andropogon annulatus, Forsk. Fl. Bomb. II, 88. Watt, Dict, Econ. Prod, Vol. 1, p. 249.
Vern. *Zinzro; Jinjvo; Motu (big) windadiyu.*

11. **Eremopogon foveolatus,** Stapf. Bomb. Gr. 96.

Andropogon fovelatus, Del. Fl. Bomb. II, 977.
Vern. *Survali; Saniyar; Surtali.*

12. **Andropogon pumilus,** Roxb. Bomb. Gr. 99, Fl, Bomb, II, 976.
Vern. *Dholio; Bhuko.*

*13. **Cymbopogon Martini,** Stapf. Bomb. Gr. 104.

Andropogon Schoenanthus, Linn. Watt. Dict. Econ. Prod. Vol. 1, p. 249.
Vern. *Rosh; Roshdo.*

*14. **Heteropogon contortus,** Roem & Schult. Bomb. Gr. 109.
Andropogon contortus, Linn. Fl. Bomb. II, 990; Watt. Dist. Econ. Prod. Vol. 1, p. 244.
Vern. *Dabhsuli; Dabhsulio; Chokhal.*

15. **Iseilema laxum,** Hack. Bomb. Gr. 113; Fl. Bomb. II, 996; Watt. Dict. Econ. Prod.; Vol. 4. p. 524.
Vern. *Ghaoolu.*

16. **Themeda quadrivalus,** O. Kuntze. Bomb. Gr. 118.
Themeda ciliata, Hack. Fl. Bomb. II, 994.
Vern. *Kaliya; Kalioo.*

17. **Brachiaria Isachne,** Stapf. Bomb. Gr. 133.
Panicum Isachne, Roth. Fl. Bomb. II, 931.
Vern. *Kaliya; Kalioo.*

18. **Brachiaria ramosa,** Stapf. Bomb. Gr. 134.
Panicum romosum, Linn. Fl. Bomb. II, 932.
Panicum Helopus, Trin. Watt. Dict. Econ. Prod. Vol. Pt. 1, p. 10 (Partim).
Vern. *Pedun.*

19. **Setaria intermedia,** Roem & Schult, Bomb. Gr. 174; Fl. Bomb. II, 920; Watt. Dict. Econ. Prod. Vol. 6, Pt. II, p. 546.
Vern. *Kuteloo.*

20. **Aristida Adscensionis** Linn. Bomb. Gr. 209; Fl. Bomb. II, 1008.
Aristida depressa Retz. Watt. Dict. Econ. Prod. Vol. 1, p. 312.
Vern. *Ooth-lampdo; Lampdo.*

21. **Eragrostis rupestris,** Steud. Bomb. Gr. 230.
Eragrostis tenella, Var. *viscosa.* Stapf. Fl. Bomb. II, 1024.
Vern. *Dandia; Chidiyo; Dundia.*

*22. **Eragrostis viscosa,** Trin. Bomb. Gr. 233.
Eragrostis tenella, Var. *viscosa.* Stapf. Fl. Bomb. II, 1024.

23. **Desmostachya bipinnata,** Stapf. Bomb. Gr. 244.
Eragrotis cynosuroides, Beauv. Fl. Bomb. II, 1028; Watt. Dict. Econ. Prod. Vol. 3, p. 253.
Vern. *Dabhdo; Durdha; Kush.*

*24. **Cynodon dactylon,** Pers. Bomb. Gr. 250; Fl. Bomb. II, 1032; Watt. Dict. Econ. Prod. Vol. 2 p. 678.
Vern. *Dhrokhad; Dharo.*

25. **Eleusine indica,** Gaertn. Bomb. Gr. 259; Fl. Bomb. II, 1037; Watt. Dict. Econ. Prod. Vol. 2, p. 678.
Vern. *Malan-Moto; Adbaoo-Nagli.*

26. **Dinebra retroflexa,** Panzer. Bomb. Gr. 264.
Denebra arabica, Jacq. Fl. Bomb. II, 1039; Watt. Dict. Econ. Prod. Vol 3, p. 115.
Vern. *Khariyum.*

*27. **Dendrocalamus strictus,** Nees. Bomb. Gr. 285; Fl. Bomb. II, 1049; Watt. Dict. Econ. Prod. Vol. 3, p. 72.
Vern. *Vans; Nakor-Vans; Bans; Nar-Vans.*

Grasslands are a conspicuous feature of Junagadh State Forest and the Gir, the headquarters of dairy produce in Kathiawar. These grasslands support approximately 30,000 head of cattle supporting as they do a small proportion of trees and large shrubs; they may be included under the general ecological type known as savannah. Locally these grasslands are known as 'Vidi'. There are of course many square miles of grazing land but 'Vidi' is particularly suitable.

The grass sprouts with the first showers of rain from reeds or rhizomes and root stocks and in a remarkably short time the grass is well grown reaching its full luxuriance in the months of October and Novembtr. The majority of species flower at the end of the rains and wither and dry up by January.

The principal members of the savannah association are *Ischaemum rugasummu* Salib., *Apluda varia*, Hack. var. *artistata*, Hack., *Dichanthium annulatum* Stapf., *Eremopogon foveolatus,* Stapf., *Cymbopogon Martini* Stapf., *Heteropogon contortus* Roem & Schult., *Themeda quadrivalus* O. Kuntze. etc.

Trees growing in association are *Butea frondosa* Konig., *Dalbergia latifolia* Roxb., *Pterocarpus Marsupium* Roxb., *Pongamia glabra* Vent., *Tamarindus indica* Linn., *Acacia arabica* Willd., *Acacia Catechu* Willd., *Acacia Jacquemontii* Benth., *Acacia Senegal* Willd., *Morinda tinctoria* Roxb., *Mimusops hexandra* Roxb., *Diospyros Melanoxylon* Linn., *Tectona grandis* Linn. and others. In fact any tree, shrub or herb found in our area may occur.

The habitats of these grasses differ. The majority are xerophytic, but species such as *Coix Lachryma-Jobi* Linn., *Polytoca barbata* Stapf., *Iscaemom rugosum* Salisb., *Brachiaria Isachne* Stapf., *Eragrostis viscosa* Trin., and *Cynodon dactylon* Pers. prefer moist places. *Cymbopagon Martini* Stapf. is particularly xerophytic both physiologically and physically. It matures very early and with minimum of rainfall maintains itself without drying up for months. The oils which it contains act as reserve and maintain turgidity.

Most of these grasses serve as fodder. Of these *Ischaemum pilosum*, Hack. *Sehima nervosum* Stapf., *Dichanthium annulatum* Stapf., *Eremopogon foveolatus*, Stapf., *Andropogon pumilus*, Roxb., *Iseilema laxum* Hack., *Themeda quadrivalus*, O. Kuntze., *Bracdiaria Isachne* Stapf., and *Cynodon dactylon* Pers. are considered good. Locally the '*Jinjvo*' is preferred to all other kinds.

These grasslands support both annual and perennial species. Some of the annuals acquire or possess adaptations which induce a perennial habit. Their erect stems becoming decumbent at the base are modified into creeping root-stock. Among these are *Eremopogon foveolatus* Stapf., *Andropogon pumilus* Roxb., *Themeda quodrivalus* O. Kuntze., *Brachiaria Isachne* Stapf. and *Brachiaria ramosa,* Stapf.

Of the 27 species noted above the following are not listed in the Bombay Grasses as occurring in Kathiawar. They are *Coixlachryma Jobi* Linn., var. *artistata*, Hack, *Iscnaemum rugosum*, Salisb., *I. pilosum* Hack., *Apluda varia* Hack., *Sorghum halepense* Pers., *Dichanthium annulatum* Stapf. *Eremopogon foveolatus*, Stapf.. *Andropogon pumilus* Roxb., *Themeda quadrivalus* O. Kuntze., *Brachiaria Isachne* Stapf., *B. ramosa* Stapf., and *Eleusine indica* Gaertn.

The following genera are recorded from Kathiawar but not the following species: *Chrysopogon montanus* Trin., *Iseilema laxum* Hack., *Setaria intermedia* Roem. and Schult. and *Eragrotis rupestris* Steud.

As a supplement to our knowledge of the occurrence and distribution of grasses in Kathiawar this paper may be of some value.

Bahauddin College, G. A. KAPADIA.
Junagadh,
August 21, 1944.

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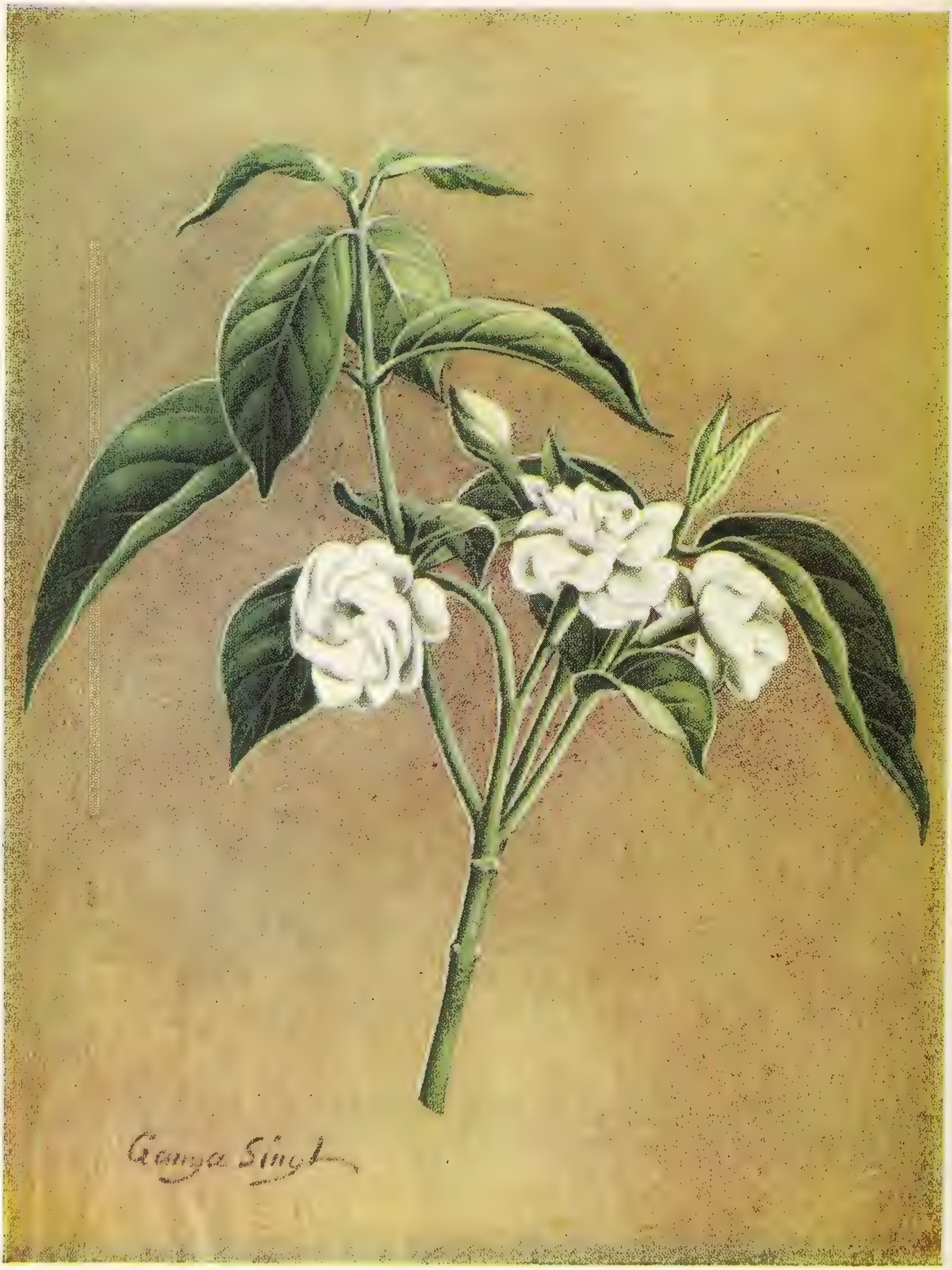
Ganga Singh

The Moonbeam
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SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

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Part XX

[*Continued from Vol.* 45, *No.* 2 (1945), *p.* 105].

(*With* 1 *coloured,* 3 *black and white plates and* 7 *text-figures*).

Apocynaceae

The Dogbane Family.

The family gets its name from the Greek name *apokynon*, used by Dioscorides in his Materia Medica to describe a plant, *Cynanchum erectum,* whose leaves were said to be deadly to dogs. Incidentally the Greek for dog is *kyon, kynos.*

This family contains many shrubs and climbers with a few species which reach the status of small trees. The vascular bundles in this family are bicollateral so that phloeum is found on the outer edge of the pith. Moreover, most species have a milky juice which is contained in non-articulated lactiferous vessels situated in the pith and bark and also in the veins in the leaves. The wood of many species is normal, but again others possess wedges of soft bast in the normal wood. The leaves are simple, opposite and decussate, seldom whorled, entire, not unusually with many

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parallel side nerves. Stipules are rarely present, sometimes interpetiolar. Flowers mostly showy, 4-5-merous, with bracts and bracteoles, hermaphrodite, usually produced in cymose inflorescences Calyx tubular or of free sepals often glandular within. Corolla gamopetalous, funnel- or salver-shaped, sometimes campanulate, or urn-shaped, with the lobes twisted in the bud, often furnished with scales in the throat. Stamens as many as the lobes of the corolla and seated upon it; anthers free, often connate and adnate to the stigma. A glandular disk is present in most of the species and takes the form of scales or is shaped like a disk. Ovary of two carpels, joined together or separate, containing many hanging ovules. Style slender. Fruit of two separate follicles, seldom drupaceous.

Carissa carandas Linn., the Karaunda, is a spiny shrub which is said to be wild and also cultivated in India. The pinkish-white fruits are very acid but are capable of being made into a very pleasant conserve by the use of plenty of sugar.

The family contains about 1100 species most of which are found in the tropics. The magnificent flowers and handsome foliage of numerous species make them valuable addition to the garden and they are widely cultivated.

A reference has been made above to the plant *Cynanchum erectum* from which the family gets its name. This plant, however, is not a member of the *Apocynaceae* but of the neighbouring family *Asclepiadaceae*. Both families are well-marked, but in one section of *Apocynaceae* the manner in which the stamens are connivent around and applied to the stigma recalls a very definite character of the *Asclepiadaceae*.

In nearly all species a milky juice is found. In certain South African lianes, for example, species of the genera *Landolphia* and *Kickxia*, quantities of latex are found, and this is tapped and marketed under the name 'silk rubber'. Other genera in India (*Alstonia* sp., *Willughbeia* sp.), Brazil (*Hancornia* sp.), Jamaica (*Forsteronia* sp.) can give a valuable rubber-yielding latex.

A large number of the species have an evil reputation on account of their poisonous properties. Many contain glucosides and alkaloids which are valuable drugs in medicine. A few species contain powerful glucosidal heart poisons which belong to the digitalis group of drugs. To this section belongs the genus *Strophanthus* which is mainly confined to Africa, though a few species are found in this country. Strophanthin is a nitrogen-free glucoside which is used by certain of the African tribes as an arrow poison. The drug has a very rapid and powerful action on the heart and is sometimes used in conjunction with digitalis, whose action is not so rapid but is more lasting. Quebracho bark (from *Cortex quebracho*, which has the hardest wood known) possesses alkaloids which are valued in the treatment of asthma and fevers. Many other species yield drugs which are put to various purposes.

Alstonia scholaris R. Br. is a common tree of the Indian jungles. It gets its specific name from the fact that in bygone days boards of the wood were used as school slates, the writing being rubbed off by the use of the rough leaves of *Delima*. The tree is called

'Devil Tree' in many places and it is an object of devotion in Malay.

The mechanism of cross pollination has been worked out in several species of *Apocynaceae.*[1] In species of *Vinca,* the Periwinkle, for example the nectar is secreted by two yellow glands near the ovary and is stored up in the corolla tube which is .5-.75 in. long. The entrance to the tube has a wall of hairs as a protection against rain. About the middle of the tube the style thickens conically and terminates in a short cylindrical horizontal plate, the edge of which functions as a stigma and is covered with a sticky secretion. The plate bears a tuft of hairs which takes up the pollen as it is shed from the anthers. The filaments, which spring from the middle of the corolla tube, are bent into 'knees' and are beset with hairs internally. The anthers are situated immediately above the stigmatic disk and dehisce introrsely. Their margins are hairy so that pollen can only fall on the terminal brush of the stigmatic disk. Nectar-sucking insects can insert their heads for a short distance into the tube, as far as the brush, so that a proboscis between .3 and .5 in. long can reach the nectar. The proboscis becomes covered with viscid matter on insertion and when withdrawn carries away some pollen to another flower. Automatic self-pollination is excluded. As a matter of fact in certain periwinkles the flowers have been proved to be self-sterile.

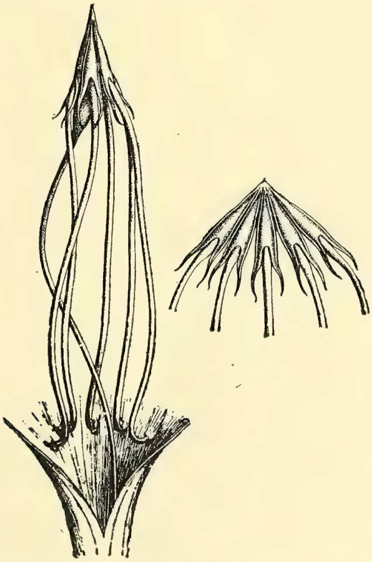

Fig. 1.—*Beaumontia grandiflora* showing stamens connivent into a cone and adnate to the stigma.

In certain species of the *Apocynaceae* the anthers are connivent around the stigma and at first sight this would seem to be a device to ensure self-fertilisation. As a matter of fact the purpose is the exact opposite, that is, to ensure cross-fertilisation. For example, in *Nerium odorum* Sol. the corolla tube encloses a cone of anthers covered outside with woody plates, and fused internally with the dilated end of the style to form a pollen chamber (in which pollen can collect) beneath which is the stigmatic surface. The anther plates are produced into points below and covered dorsally with hair. Each stamen is drawn out into a long terminal appendage, which is filiform at its base and then becomes broader and feather-like. These fine appendages are twisted together into a loose, woolly, whitish ball, which with the corona blocks the entrance of the flower in such a way that only long-tongued Lepidoptera are able to penetrate to the nectar. The woody plate on the back of the anthers prevent these being gnawed away in order to open a passage to the nectar. Actually the proboscis of the insect must be inserted in the chinks between the plates. In its withdrawal the proboscis passes over the stigma, becomes sticky, and carries out some pollen on it. This is transferred to the next flower visited. Very often a number of insects which are not adapted to carry out the process are caught by the anther plates and are killed.

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[1] See Knuth's *Handbook of Flower Pollination.*

KEY TO THE GENERA.

Flowers yellow.
Leaves very narrow. ... *Thevetia.*
Leaves broad. ... *Allamanda* sp.
Flowers blue or violet.
Flowers blue. ... *Vinca major.*
Flowers violet or purplish. ... *Allamanda violacea.*
Flowers red.
Leaves narrow. ... *Nerium.*
Leaves broad. ... *Vinca rosea.*
Flowers white or pinkish white.
Leaves whorled. ... *Nerium.*
Leaves opposite.
Shrubs.
Flowers not over .5 in. wide : leaves very coriaceous, tip sharp. ... *Acocanthera.*
Flowers well over .5 in. broad : leaves soft.
A small herbaceous shrub. ... *Vinca rosea.*
A large shrub. ... *Tabernaemontana.*
Climbers.
Flowers large, up to 4 in. long.
Flowers campanulate. ... *Beaumontia.*
Flowers salver-shaped. ... *Chonemorpha.*
Flowers less than 2 in. long.
Corolla-lobes orbicular obovate in shape.
Petals orbicular; tube .3 in. long; flowers creamy white; no corona. ... *Vallaris.*
Petals obovate; tube 1.5 in. long; flowers white tinted with rose; corona present rose-coloured. ... *Strophanthus.*
Corolla lobes ovate-lanceolate or oblong truncate.
Tube slender below, abruptly inflated. ... *Trachelospermum.*
Tube gradually swelling above. ... *Melodinus.*

Thevetia Linn.

(This generic name commemorates Andre Thevet, a French monk of the sixteenth century who travelled in Brazil and Guiana).

This genus contains a few glabrous shrubs and trees with alternate leaves. The large yellow flowers are borne in terminal cymes. Sepals five, spreading, glandular. Petals five, twisted, combined below into a companulate tube. Stamens five, inserted at the top of the tube; anthers short, lanceolate, without appendages. Disk usually absent. Ovary 2-celled with a filiform style, ending above in a thick two-lobed stigma; ovules two in each cell seated on a conspicuous placenta. Berry fleshy.

Thevetia neriifolia Juss. [*T. peruviana* (Pers.) K. Schum.]

(*Neriifolia* means in Latin, having leaves like Nerium, the Oleander).

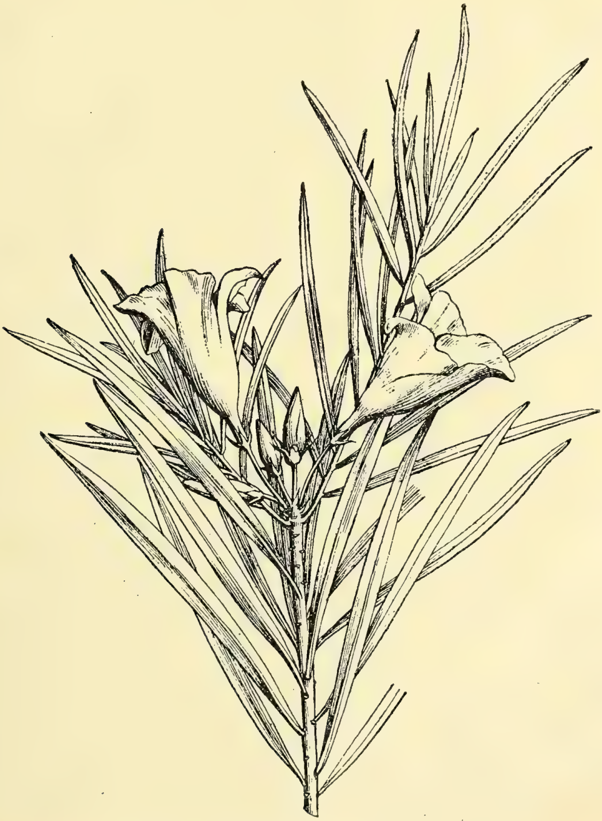

Fig. 2.—*Thevetia neriifolia* Juss. × $\frac{3}{4}$

Description.—A shrub or small tree, sometimes reaching 12 ft. in height. Stems and shoots quite glabrous, exuding a copious milky juice when cut. Leaves alternate up to 6 in. long by .3-.4 in. broad, narrowly linear in shape, shortly acuminate and obtuse at the apex, decurrent at the base, shining green above, paler and dull below, coriaceous, glabrous; margins revolute; central nerve very prominent below; secondary nervation invisible.

Flowers yellow, arranged in subterminal few-flowered cymes, seated on pedicels from .3-1.25 in. long. Sepals 5, about .3 in. long, long acuminate, sharp, spreading, thin, joined below into a short tube. Petals 5, 1 in. or longer in length, oblong-acute joined below into a tube which is about 1 in. long cylindrical at the base and broadly campanulate at its junction with the petals, decorated with two hairy wings in the cylindrical portion and with hairy scales at the base of the campanulate portion. Stamens five, inserted on the throat of the corolla below the scales; filaments short; anthers minute oblong, shortly acuminate, with a lamellate appendage. Disk present, thick, fleshy, as high as the ovary; ovary bicarpillary; style slender, .5 in. long. Fruit drupaceous, fleshy, usually four-angled; seeds four.

Flowers and fruits.—Practically throughout the year.

Distribution.—Native of tropical America, cultivated or naturalised throughout India.

Gardening.—A large evergreen shrub or small tree with alternate, 1-nerved linear leaves and large fragrant yellow, or even creamy-white, funnel-shaped flowers about 2 in. across. It is a great favourite with Hindus and is frequently cultivated near temples, the flowers being offered to the God Shiva. As the plant requires little attention, is easily grown from seed, transplants well, and is not touched by cattle or goats, it is useful for growing in rest-houses etc. It was brought into cultivation in Europe in 1735 and from there distributed to the tropics in general, as a showy and ornamental plant. Owing to its immunity from damage by browsing and the ease with which it is propagated it might be useful for afforestation work in moister parts of the country. It is also suited for a hedge.

Medicinal and economic uses.—The wood is moderately hard and the seeds yield an oil used for burning as well as in medicine. All parts of the plant are poisonous, owing to the presence in the latex of a glucoside which acts as a heart-poison. The seeds were at one time used for animal poisoning and accidental cases of poisoning by eating its seeds are not infrequent. According to Heyne its wood is a fish-poison.

Allamanda Linn.

(The genus was erected in honour of Dr. Allamand of Leyden).

A genus of shrubs with handsome flowers. Leaves verticillate with interpetiolar glands. Flowers arranged in axillary cymes, showy, yellow or purple. Calyx-lobes acute, conspicuous, without glands. Corolla funnel-shaped, 5-lobed; lobes spreading. Stamens inserted at the upper end of the cylindric basal tube, covered by the hairy appendages of the throat. Ovary of two

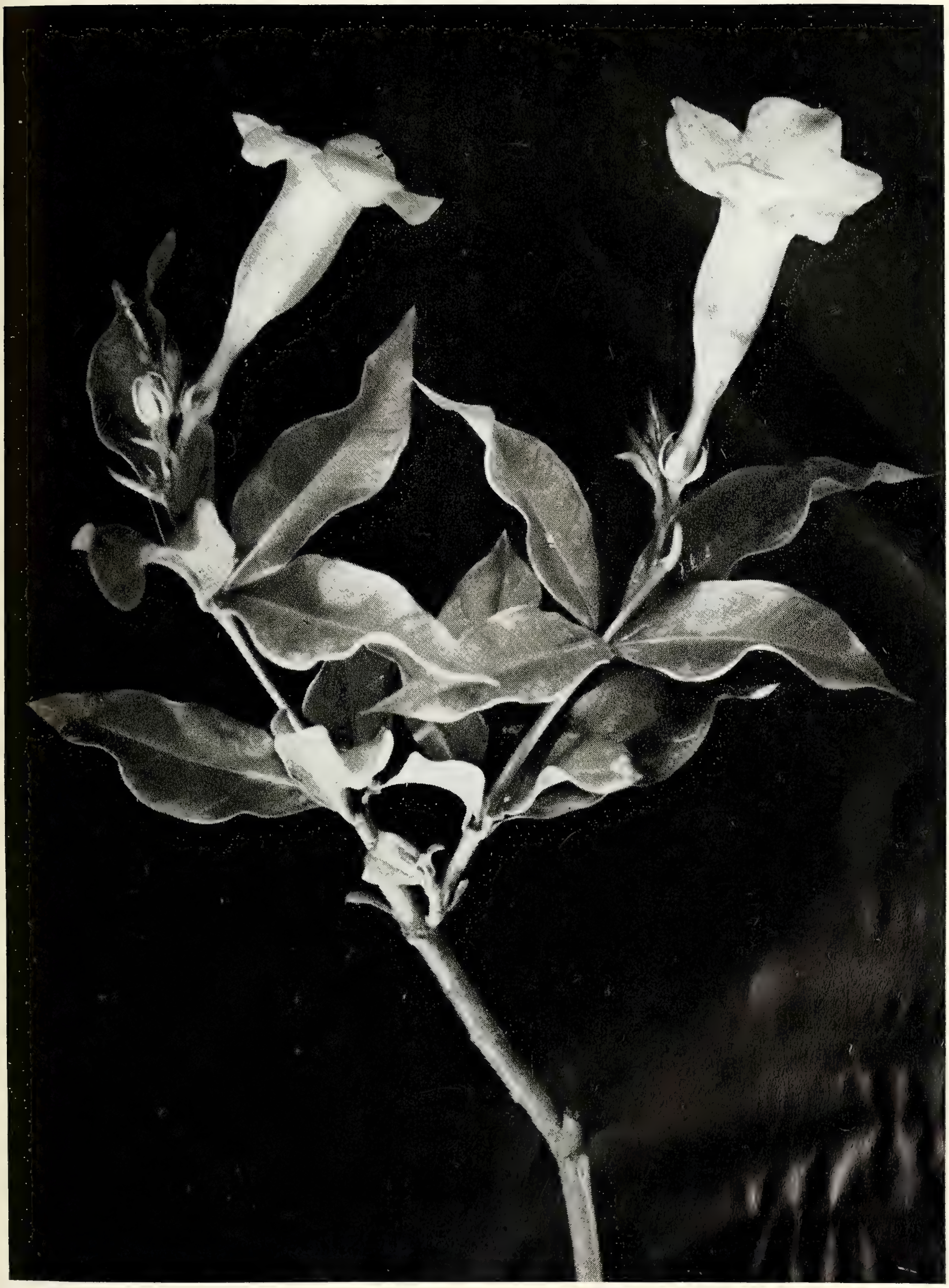

Photo by M. B. Raizada.

THE ALLAMANDA
Allamanda neriifolia Linn.
New Forest, Dehra Dun.

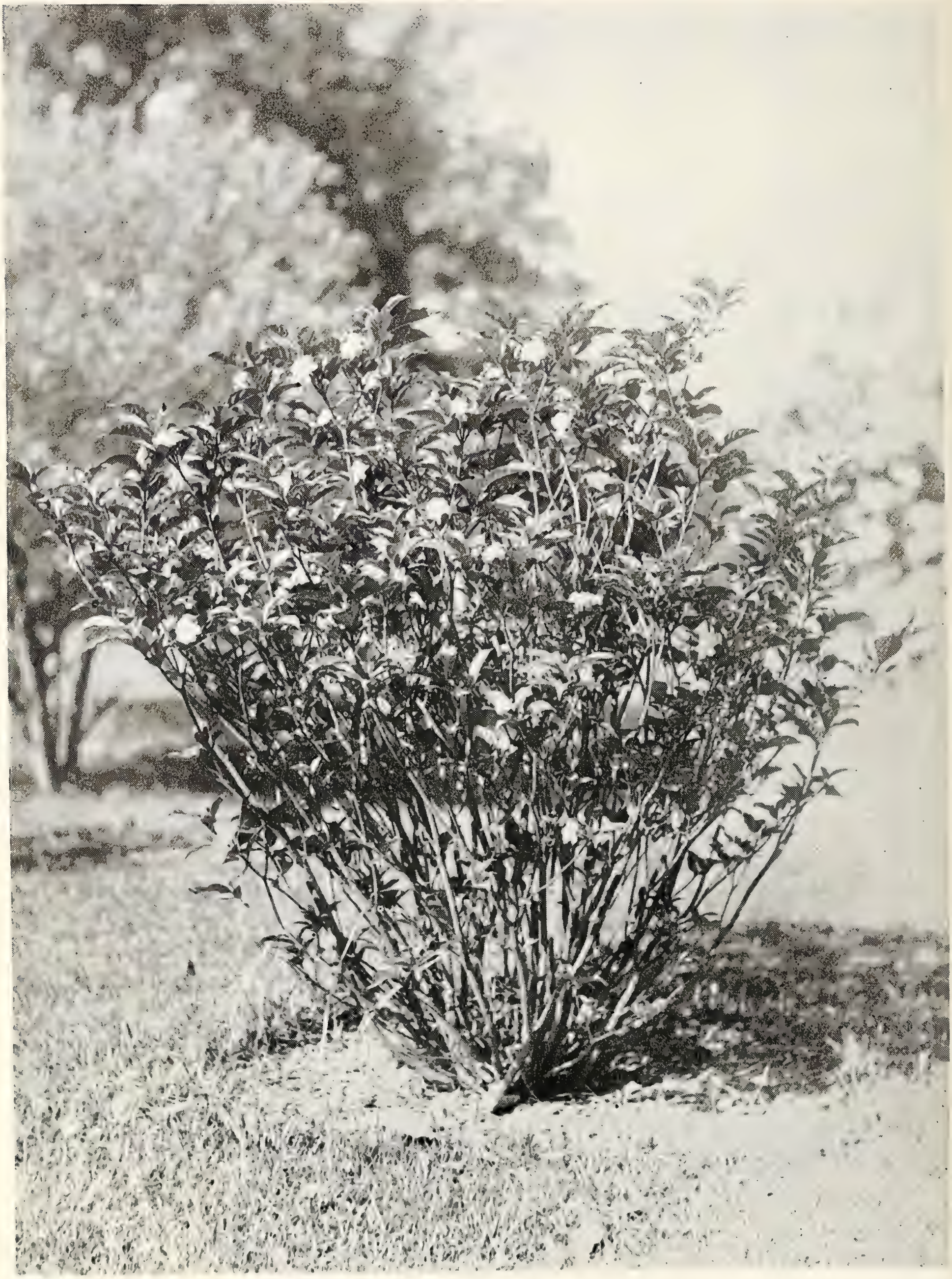

Photo by M. B. RAIZADA.

THE ALLAMANDA

Allamanda neriifolia Hook.

New Forest, Dehra Dun.

connate carpels, 1-celled, with numerous seeds on two parietal placentas, surrounded by a small annular disk; style filiform; stigma capitate. Fruit a globose prickly capsule. Seeds winged, flat.

KEY TO THE SPECIES.

Flowers yellow :	
Base of corolla swollen.	... *A. neriifolia.*
Base of corolla not swollen.	... *A. cathartica.*
Flowers violet or purplish.	... *A. violacea.*

Allamanda neriifolia Hook.

(*Neriifolia* means having leaves like the Oleander, but in the case of this plant the leaves are very different from those of the Oleander).

Description.—An evergreen shrub or half climber. Stems terete, woody below herbaceous above, smooth and glabrous, but covered with down when young. Leaves in whorls of two to five, elliptic or ovate-acuminate in shape, petiolate, dark green above, pale below, shortly hairy on the midrib and principal veins, otherwise glabrous; petiole very short.

Inflorescence a terminal panicle becoming lateral owing to the production of new shoots which continue the growth. Flowers large, conspicuous, showy, golden-yellow, seated on short, terete pedicels up to .5 in. long; bracts .12 in. long, green. Calyx of five unequal sepals, elliptic-ovate in shape, light green in colour, ·6 in. long. Corolla-tube 2 in. long; base swollen, angled, bulbous, green, swelling into the golden yellow tube, which divides above into five orbicular or oval, spreading, obtuse lobes .5 in. long. The tube is striped inside with reddish brown. Stamens five, situated at the bottom of the tubular portion of the corolla, included. Ovary 1-celled, with many ovules on two parietal placentas. Fruit unknown.

Flowers.—Hot and rainy season. Does not fruit in this country.

Distribution.—A native of Brazil, commonly cultivated in all tropical and sub-tropical parts of the globe.

Gardening.—A dwarf bush or semi-climber. It differs from all other Allamandas here described, in its habit as also in the form of the corolla, with its singularly short contracted base of the tube, swollen and angled at the base, and very elongated upper portion; the colour is a deep almost golden yellow, and it is streaked with orange. It is well adapted for planting against a back wall or for training up pillars. It also flowers freely when treated as a pot plant, the branches being supported either by stakes or a wire trellis. A mixture of light loam and leaf mould suits it very well and during the season of growth it needs a free supply of water. It is readily increased by cuttings and layers.

Allamanda cathartica Linn.

Description.—An evergreen glabrous shrub which is capable of assuming a climbing or rambling habit. Branches smooth, green, hairy or not. Leaves opposite in whorls of four, obovate or oblanceolate in shape, cuneate at the base, shortly acuminate at the tips, papery to sub-coriaceous in texture, glabrous or more or less hispid or pubescent especially on the nerves, intramarginal nerve conspicuous; petiole very short.

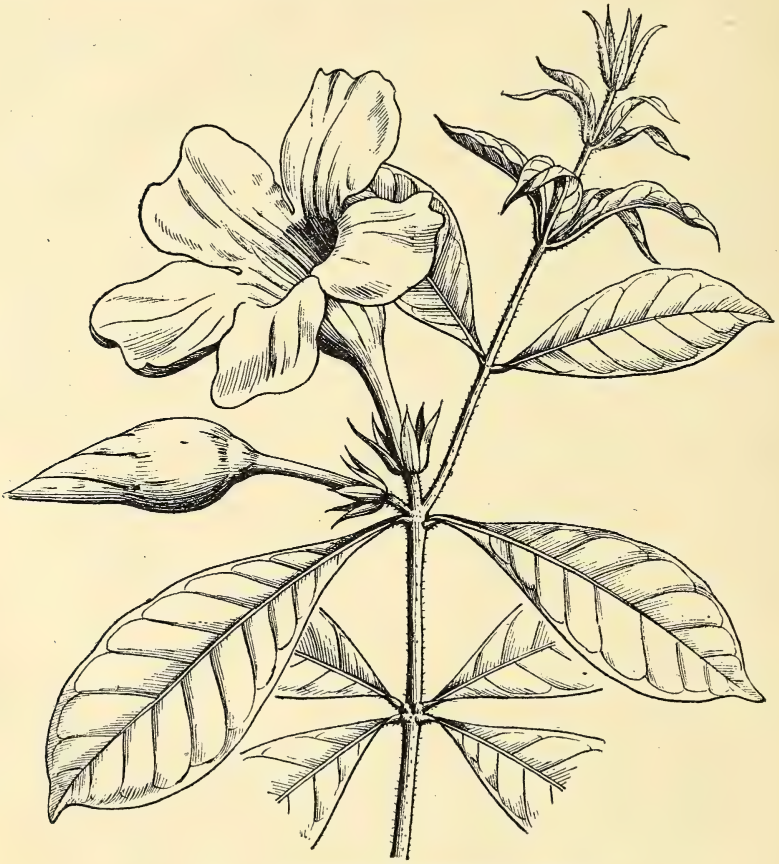

Fig. 3.—*Allamanda cathartica* Linn. × ½

Flowers large and showy, yellow, in terminal (afterwards axillary) cymose panicles; bracts deciduous. Calyx of five sepals, glabrous or hairy without, lanceolate in shape, .3 in. long. Corolla of two distinct portions: a lower, which is tubular, about 1 in. long and very narrow, and an upper which is campanulate and about .5 in. in diameter, ending above in five orbicular lobes, 1-1.5 in. long. Stamens five, included. Ovary 1-celled, with numerous ovules on parietal placentas. Fruit a globose prickly capsule; prickles soft about .3 in. long. Seeds many, obovate, flat, winged.

Flowers.—Hot and rainy seasons. Fruits cold season but only rarely.

Distribution.—Native of tropical America now extensively grown throughout the tropical and sub-tropical parts of the world. In recent years it has run wild near Travancore.

Gardening.—A rather large shrub of scandent and rambling habit. It is one of the commonest plants in all tropical gardens and one of the showiest and ornamental. The large, pure, bright yellow flowers are borne in great profusion during the hot and rainy seasons and produce a most magnificent effect against the rich deep-green foliage. Like all other species of this genus it should be fed liberally with natural or artificial manures during its growing season as it is a gross feeder. It should be cut well back during the cold season to keep it within bounds. It was introduced into England in 1785 by Baron Hake where it thrives well and is considered to be one of the choicest ornaments of the hothouse. Easily propagated by cuttings and layers.

A. cathartica Linn. var. *Schottii* (*A. Schottii* Pohl.) is a plant with broadly lanceolate, acuminate leaves and longer corolla tube, which is rich yellow with the throat darker and beautifully striped. Propagation is by layers and cuttings.

A. cathartica Linn. var. *nobilis* (*A. nobilis* T. Moore) is according to Sir Joseph Hooker 'a magnificent plant, imported into England in 1867 from Rio Branco, on the confines of Brazil and Venezuela, by a Mr. Bull of Chelsea and is certainly one of the finest hothouse climbers in cultivation. It is very doubtful if this is botanically distinct from *A. Schottii* and *A. Hendersonii*, but as a horticultural acquisition it differs from these and surpasses them individually, either in habit or in the large size and full green of the foliage, or in the very large flower, its regular contour and bright colour, or in the number of flowers produced, or in their magnolia-like odour—altogether rendering it one of the most gorgeous free-flowering stove-plants introduced into Europe for many years past'. Propagated by cuttings or layers.

It is perhaps the most popular and widely grown of all the Allamandas and the reason for this, apart from the beauty of its flowers, may be found in its strong-growing and free-flowering propensities. It produces a succession of lovely flowers over a very long period. Trained over a rafter or porch, its handsome foliage and large, golden flowers present a fine spectacle. The plants succeed admirably in a compost of three parts good fibrous loam and one part of wood charcoal, coarse sand and well-rotted cow manure. Drainage must be ample and free and all possible sun light must be provided.

Allamanda violacea Gardn.

(The specific name refers to the colour of the flowers).

Description.—An erect, sometimes scrambing shrub, with terete branches which are glabrous when old but hirsute when young. Leaves verticillate, 3-5 in. by 1.5 in., very shortly petioled, oblanceolate, elliptic or oblong in shape, cuneate at the base, abruptly acuminate at the apex, entire on the margins, rough on both surfaces with short, stiff, stout hairs; hairs on the midrib below and on the margins particularly stiff and sharp; nervation evident but not particularly prominent; stipules small.

Inflorescence a few-flowered cyme, terminal. Calyx of five separate lobes, the two outer elliptic in shape, the three interior lanceolate, bristly hirsute. Flowers large and showy, violet, purplish-brown or purplish. Corolla-tube up to 2·5 in. long, of two distinct parts, the lower tubular narrow and the upper campanulate up to 1 in. in diameter, ending above in five orbicular or broadly ovate lobes, .75 in. long, glabrous without. Stamens five, inserted at the base of the campanulate portion of the corolla, included, covered with the hairy appendages of the corolla; filaments very short. Ovary of two connate carpels, containing numerous ovules on two parietal placentas. Style filiform ending above in a capitate stigma.

Flowers.—Hot and rainy season. Does not set fruit in this country.

Distribution.—A native of Brazil, now cultivated in all tropical and sub-tropical countries of the world.

Gardening.—A fine, handsome, slender growing climber, quite distinct from all other species and varieties in the colour of its flowers. It is a poor grower on its own roots, but thrives well when grafted on *A. cathartica* var. *Schottii.* It prefers a well-drained soil and a sunny site like most other species of this genus.

Medicinal uses.—The root is said to be a powerful cathartic and is used in malignant fevers.

Nerium Linn.

Dioscorides in his Materia Medica gave the Greek name *nerion* to the plant *Nerium odorum* Sol.)

A genus of erect glabrous shrubs. The leaves are arranged in whorls of threes, and are coriaceous, narrow, with obscure nervation. The inflorescence is of terminal branchy panicles. Calyx divided nearly to the base into 5 lobes, glandular inside. Corolla tubular below, campanulate above, ending in five twisted petals. Stamens five, included, fixed to the base of the campanulate portion of the corolla; anthers connivent round the stigma and adherent to it. Ovary of two distinct carpels; ovules numerous. Fruit dry, of two connate carpels. Seeds oblong, hairy.

Nerium odorum Sol. (=*Nerium indicum* Mill.).

The Oleander.

Description.—A glabrous erect shrub. Young shoots greenish, thin, brown, emitting quantities of milky juice when cut. Leaves mostly in threes, sometimes in twos, opposite, 4-6 in. long by .3-.9 in. wide, linear-lanceolate in shape, tapering at both ends, thick, coriaceous, with a thick midrib, decurrent at the base; petiole .2-.3 in. long, thick.

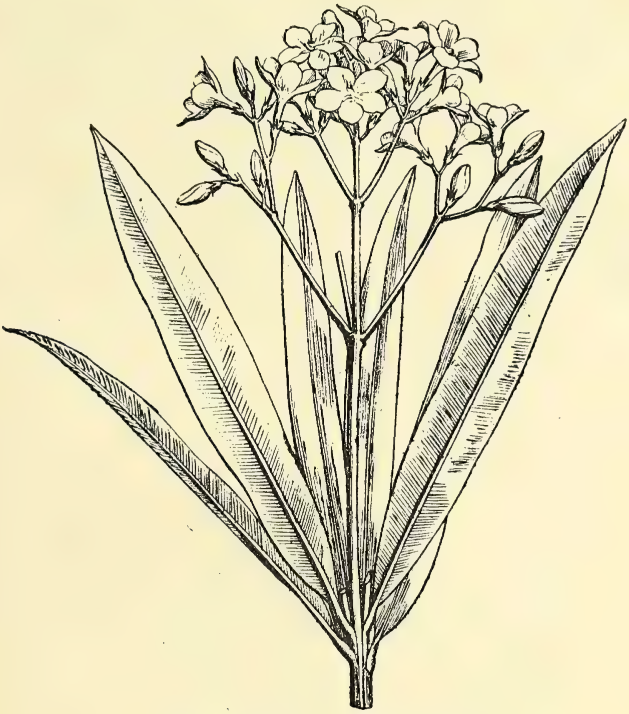

Fig. 4.—*Nerium odorum* Sol. × 3/4

Flowers arranged in terminal panicles, pink or white, single or double, fragrant; peduncles and pedicels minutely pubescent; bracts small, .3 in. long. Calyx .25 in. long divided nearly to the base into five linear, acute, pubescent lobes. Corolla-tube .7 in. long, lower half tubular, hairy within, upper half campanulate, ending above in five rounded overlapping petals. In the throat of the corolla can be found a corona of five scales, each cleft into 3-7 segments. Stamens five, included; filaments short; anthers connivent into a cone and adherent to the stigma; connective with two long thread-like hairy appendages. Disk absent. Carpels 2, distinct; style filiform thickened upwards; stigma 2-lobed. Follicles connate, 5-8 in. long by .3 in. wide. Seeds small, .2 in. long, each topped by a tuft of brown hairs .5 in. long.

Flowers and fruits most of the year in cultivation.

Distribution.—Found from Persia to China and Japan; frequently grown in gardens throughout the country.

Gardening.—A large, evergreen, hardy, beautiful shrub with narrow, deep green, tapering leaves, and deep rose or white, fragrant flowers. The plant is very poisonous and is not touched by cattle or goats. It is commonly grown in gardens with single or double flowers, the double pink variety being perhaps the favourite. Easily multiplied by cuttings or layers during the rains. It is suitable for a screen or as a hedge plant. This shrub is considered the glory of the gardens of Northern India where during the hot season it thrives vigorously and being always in bloom, scents the whole air round with its perfume.

Medicinal and economic uses.—Every part of the plant is poisonous and contains a glucoside allied to digilatin which acts as a heart poison. There is 2½ times as much poison in oleander leaves as in digitalis. The roots if taken internally are highly poisonous but a paste is reputed to be useful in skin diseases. The leaves boiled in oil yield a medicated ointment which is used in skin diseases.

Vinca Linn.

Periwinkle.

(In his Natural History, Plinius called the plant by the name *vinca pervinca,* by which it is known in Italy even to the present day).

This genus comprises upright or prostrate herbaceous shrubs with opposite leaves and a milky juice. Inflorescence of axillary flowers. Calyx of five narrow acuminate sepals. Corolla-tube cylindrical somewhat dilated at the level of the stamens; lobes five, spreading. Stamens five, included; anthers without an appendage at the base. Disk of two scales. Ovary of two distinct carpels; style filiform; stigma annular; ovules 6-8, in two rows in each carpel. Fruit of two follicles.

Two species of this genus are common garden plants in India and can be separated easily by the shape of the leaf.

KEY TO THE SPECIES

Leaf oblong, obtuse; petioles very short .1 in. long ...	*V. rosea.*
Leaf heart-shaped, acute, petioles over .25 in. long. ...	*V. major.*

Vinca rosea Linn.

[*Catharanthus roseus* (L.) G. Don].

Madagascar Periwinkle.

Description.—The species is a herbaceous shrub reaching 2.5 ft. in height with numerous, erect branches; young parts hairy. Leaves opposite, oblong, occasionally oblanceolate, obtuse, cuneate at the base, membranous, up to 3 in. long by 1 in. broad, smooth and glabrous, shining green above, paler below; nervation not marked; petiole up to .5 in. long.

Flowers solitary in the axils of the upper leaves, pink or white, very fragrant, seated on very short pedicels. Calyx-tube very short

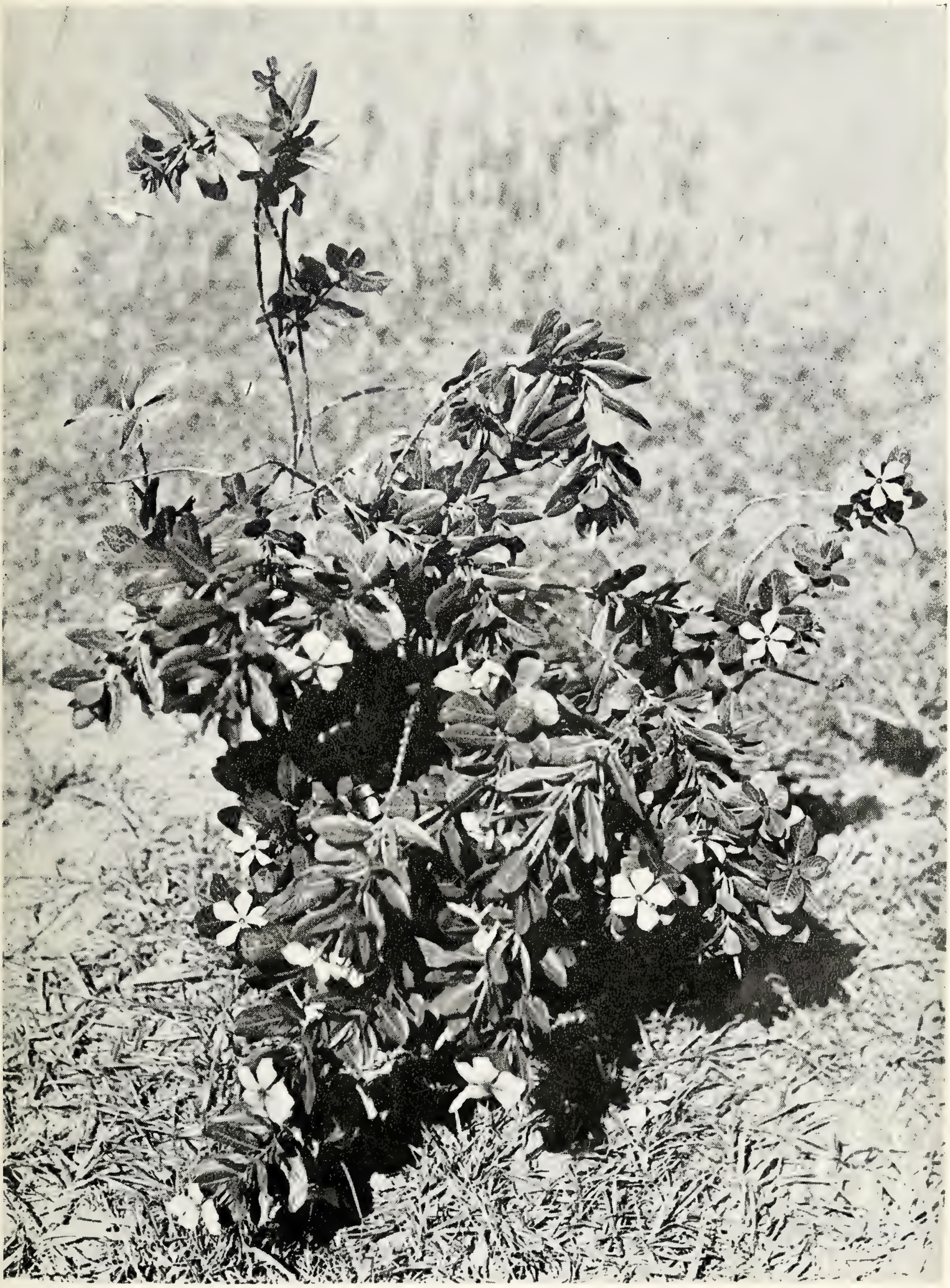

Photo by M. B. RAIZADA.

MADAGASCAR PERIWINKLE
Vinca rosea Linn.
New Forest, Dehra Dun.

divided above into five sepals, which are linear acute in shape, hairy on the back and about .2 in. long. Corolla-tube 1-1.25 in. long, hairy outside, somewhat inflated above, with a narrow throat, having a hairy ring inside below the stamens and with hairy rugosities above; lobes five, oblong-rounded, about 1 in. long, spreading. Stamens five, situated on the swollen portion of the tube; filaments very short. Disk present, higher than the ovary, consisting of two narrow, obtuse, fleshy scales. Ovary of two separate and distinct carpels, hairy at the top; style about 1 in. long; ovules many. Fruit of two follicles.

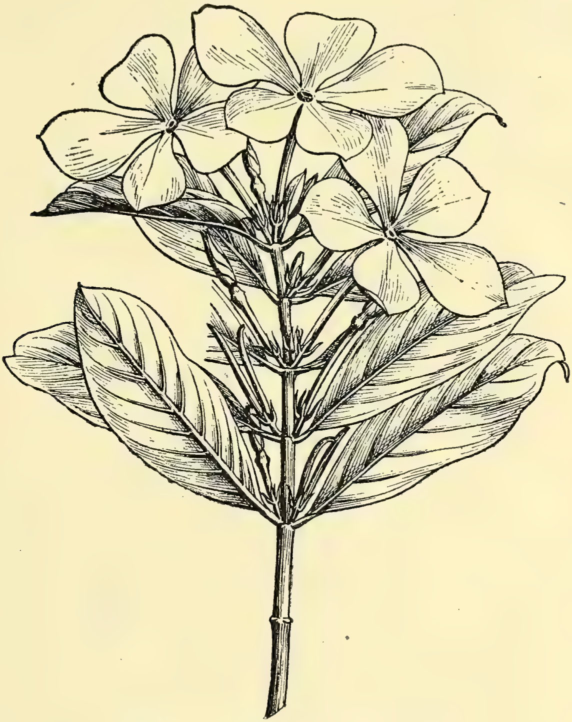

Fig. 5.—*Vinca rosea* Linn. × $\frac{3}{4}$

Flowers and *fruits* all the year round.

Distribution.—Probably a native of the West Indies commonly grown in gardens all over the country where it springs up readily self-sown.

Gardening.—A beautiful herbaceous or somewhat woody shrub 2-3 ft. high with deep green, polished oval or oblong leaves and pure white or deep rose-coloured flowers in axillary pairs. When in full bloom, as it nearly always is, is a lovely plant. Very readily raised from seed which it produces abundantly.

Vinca major Linn.

Greek Periwinkle.

(*Major* is a Latin word meaning larger).

Description.—A perennial woody herb up to 3 ft. tall. Stem prostrate rooting at the nodes and creeping over the soil, the vertical shoots producing flowers. Leaves opposite, petiolate, broadly ovate in shape, obtuse or acute at the tip, rounded or almost heart-shaped at the base, membranous or somewhat coriaceous in texture, up to 2 in. long by 1.5 in. broad, finally hairy on the margins, glabrous and smooth elsewhere; petiole up to .5 in. long, grooved above, margins hairy.

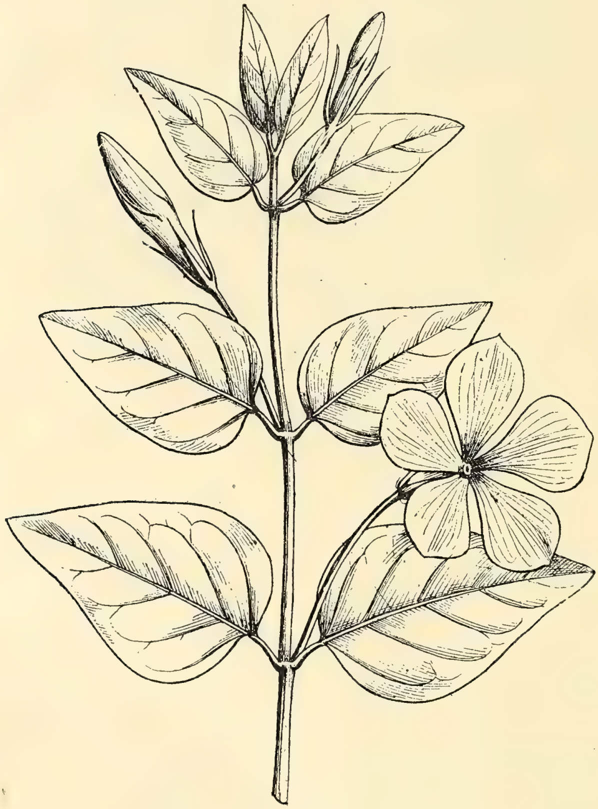

Fig. 6.—*Vinca major* Linn. × $\frac{3}{4}$

Flowers arising singly from the axils of the upper leaves, bright blue or violet, rarely white; pedicel up to 1.5 in. long. Calyx-tube campanulate, very short, ending above in five, narrow, almost setaceous lobes which are hairy along the margins, .5-.75 in. long; towards the base of the lobes are marginal glands on either side. Corolla tube as long as the calyx-lobes; tubular portion short, dilated towards the mouth where the stamens are included; lobes five; stamens five; filaments short curved, arising from a tubercle, hairy below, anthers oblong, ending above in a hairy hooded appendage. Ovary of two distinct carpels; style about .5 in. long; stigma capitate. Disk of two almost orbicular, fleshy, glandular scales.

Flowers.—December-March. Does not fruit in this country.

Distribution.—A native of Europe, often grown in gardens in the hills and in the plains of this country. Recently it has run wild in Barlowganj, below Mussoorie and in Simla.

Gardening.—A small evergreen under-shrub, trailing over banks etc. The solitary, axillary, blue flowers which are about an inch across are very pretty. Propagation is by cuttings and seed. It is suitable, especially the variegated form, for verandah-boxes, hanging baskets and the like.

Acocanthera G. Don.

(This generic name means 'mucronate anthers' and refers to the fact that in the species of this genus the connective of the stamens is produced into a minutely pilose point).

Unarmed shrubs or small trees with opposite very coriaceous leaves. Flowers numerous, peduncled or sessile, in axillary clusters, sweet-scented, white or pink. Calyx small, of free sepals. Corolla salver-shaped, tube slightly widened near the mouth; lobes five, short. Stamens five, included in the widened part of the tube; anthers ovate; connective produced into a point. Disk absent. Ovary entire, 2-celled; style filiform; stigma with a 2-lobed apiculus; ovule 1 in each cell. Fruit a globose or ellipsoid berry.

Acocanthera spectabilis Hook. f.

Winter Green.

(*Spectabilis* means showy in Latin).

Description.—A glabrous shrub or even a small tree. Leaves opposite and decussate, very coriaceous in texture, elliptic or oblong-lanceolate, acute, usually mucronate, acute at the base, 2.5-5 in. long, 1-2 in. broad, dark green above, paler beneath, glabrous; petiole short, stout.

Flowers in short, many-flowered, dense, subsessile clusters or corymbs. Calyx of five pubescent, ovate-lanceolate, green or whitish sepals, .15 in. long. Corolla white, tinged with pink, fragrant; tube .7-.9 in. long, pubescent or almost glabrous without, hairy within. Lobes five, elliptic-acute, up to .25 in. long; stamens five, alternate with the lobes, seated on short, hairy filaments and included; anthers ovate; connective produced into a short hairy point. Ovary 2-celled; style filiform; stigma short, cylindric, obtusely apiculate. Fruit a small, purplish-black berry.

Flowers.—April. Does not fruit in Dehra.

Distribution.—A native of western districts of South Africa, now cultivated throughout the tropical and sub-tropical parts of the world.

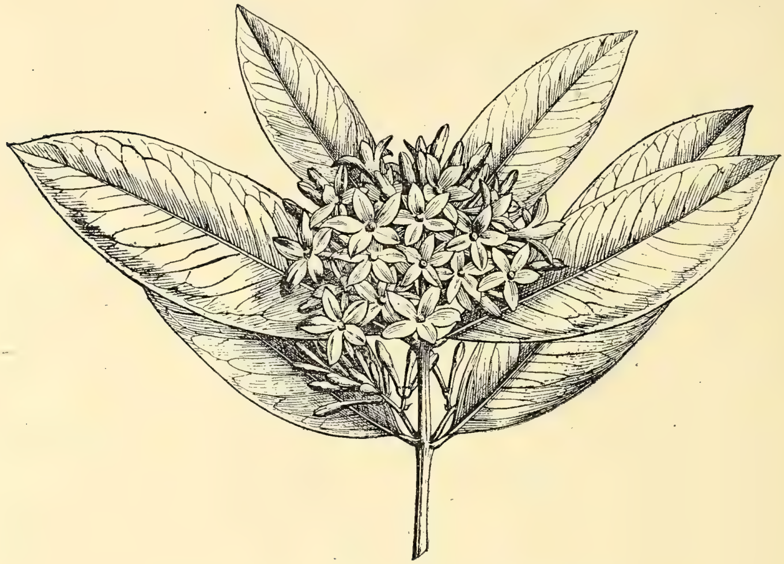

Fig. 7.—*Acocanthera spectabilis* Hook. f. × ¾

Gardening.—An evergreen shrub with dark green leaves. The masses of white flowers which are produced at the commencement of the hot weather are very fragrant and make this plant very ornamental. According to Sir J. D. Hooker it was introduced into England by Mr. B. S. Williams about 1872. Propagation is by cuttings or seed.

Economic and medicinal uses.—The seeds are intensely bitter and the whole plant is deadly poisonous.

Tabernaemontana Linn.

(Linnaeus named this genus in honour of James Theodore Tabernaemontanus of Heidelberg, a physician and botanist of the 16th century).

This genus consists of glabrous shrubs and small trees with thin or coriaceous, opposite leaves. Inflorescence of few-flowered cymes seated on a short peduncle. Calyx of five, imbricate, glandular sepals. Corolla, tubular ending in five petals, hypocrateriform; tube swollen at insertion of stamens. Stamens five, inserted towards the middle of the tube bearing sagittate anthers. Disk absent. Ovary of two distinct or separable carpels; ovules numerous. Fruit often of two follicles.

Tabernaemontana coronaria R. Br.

[*Ervatamia divaricata* (L.) Burkill].

The Moonbeam; Chandnee.

(*Coronarius* means 'used for or pertaining to garlands' in Latin, and refers to one use to which the flowers are put).

Description.—A glabrous shrub reaching 6 ft. in height, exuding a copious milky juice when cut. The young shoots are bright green in colour and lenticellate. The leaves are 3-6 in. long by 1-2.5 in. broad, elliptic-oblong, obovate or oblanceolate in shape, attenuate more or less caudate at the tip; acute or obtuse, cuneate at the base, membranous in texture, dark green; petiole .5 in. long or less.

Inflorescence of geminate or solitary few-flowered cymes in the axils and also terminal. Flowers often double, white, fragrant. Calyx gamosepalous; tube campanulate, 1 in. long, ending in 5 oblong-acute-lobes about .35 in. long, glandular inside at their base. Corolla-tube .75 in. long, cylindrical, slightly dilated below the top where it divides into five obliquely ovate lobes which are horizontal, and about .5 in. long. Stamens five, inserted in the dilated portion of the tube; filaments short; anthers .15 in. long. Ovary of two distinct carpels, with a long style ending in an obovoid stigma. Ovules inserted in two series of 3-4. The fruit consists of two recurved, fleshy follicles 1-3 in. long, green outside, orange or bright red within. When ripe the follicle splits and turns inside out.

Flowers.—Hot and rainy season. *Fruits* cold season.

Distribution.—Undoubtedly wild and very commonly cultivated in gardens throughout India.

Gardening.—A handsome, evergreen shrub, 4-6 ft. high. The large, pure white flowers, which are usually double in cultivation, are found on the plant at all seasons and look very lovely against the dark green, shining foliage. The flowers are inodorous by day but sweet-scented at night and are used for making garlands. It is suitable for a hedge as well as growing on lawns. Propagated easily by layers or cuttings.

Economic and medicinal uses.—According to Watt in the Himalayas the pulp of the seeds is used as a red dye, and the wood medicinally as a refrigerant and is burnt for incense and used in perfumery.

(*To be continued*)

MATERIALS FOR THE ORNITHOLOGY OF AFGHANISTAN

BY

HUGH WHISTLER (deceased).

PART IV

(Continued from Vol. 45, No. 2 (1945), p. 122).

Martula urbica urbica (L.).

Specimens collected.—3 ♂ 23-26 April 1937 Bamian 8,500 ft. (Meinertzhagen).

Meinertzhagen says that House-Martins on passage were passing north through Bamian in small parties from 22-26 April. At Doshi on 1 May and at Danaghori on 3 May many were passing north in scattered parties and often in company with European Swallows.

In the Ghorband Valley on 24 May a large mixed flock of Swifts, Sand-Martins and House Martins appeared, busy feeding and out of range. These may well have been breeding in the neighbouring mountains as also a few seen, but not obtained, in the Paghman Valley near Kabul at 8,000 ft. on 27 May.

[**Chelidon cashmeriensis** Gould.

Whitehead found the Kashmir Martin fairly numerous in summer along the Safed Koh range, nesting either singly or in small colonies under overhanging crags from 6,000-8,000 ft. It has not yet been recorded actually on the Afghan side of the border].

Krimnochelidon rupestris (Scopoli).

Specimens collected.—♂ juv. 6 August 1885 Puzah-Gish, Mt. Doshakh (Aitchison); sex? 18 May Darband-i-Kil Rekhta (Yate): ♂ ♀ 12 April Paghman 8,000 ft., ♀ 18 April 1937 Ghorband 8,200 ft. (Meinertzhagen).

Meinertzhagen says that the Crag-Martin was never absent from its typical country between 5,000 ft. and 9,000 ft. and was breeding in the crags wherever he met with it. Birds were brooding on 18 April and young were seen on the wing on 24 May in the Paghman Valley. Aitchison on the other hand who was no doubt mostly at lower elevations says he only saw the bird at Puzah-Gish and then in small numbers. Yate obtained it at Darband-i-Kil Rekhta.

On the eastern border Wardlaw-Ramsay found it abundant in the Hariab Valley 7,000-8,000 ft. in June and it appeared to be nesting in the cliffs above his camp. Whitehead also found it nesting in fair numbers in the precipices of the Safed Koh just across the border.

Krimnochelidon obsoleta pallida Hume.

Specimens collected.—♀ 13 March 1896 Lijjikarez 2,400 ft., ♀ 20 March 1896 Samuli 4,500 ft. (Maynard).

These specimens provide the only records of the Pale Crag-Martin in Afghanistan.

Riparia riparia ijimæ (Lönnberg).

Specimens collected.—♂ ♀ 1 May 1937 Barfak (Meinertzhagen).

Meinertzhagen found a small party of Sand Martins, which he identified as of this form, feeding over grassland at Barfak. From the state of their organs they were clearly not breeding in the neighbourhood.

Riparia riparia diluta (Sharpe and Wyatt).

Specimens collected.—Sex? Afghanistan (Griffith); ♂ 5 May Danaghori 2,500 ft., ♂ ♀ 19 May Baghlan 1,700 ft. (Meinertzhagen).

'At Danaghori there were many Sand Martins about from 3-7 May, but probably not breeding. At Baghlan there were hundreds sitting on telegraph wires on 19 May and from their organs they were almost certainly breeding in the neighbourhood, though we never located the communal breeding bank. In the Ghorband Valley on 24 May there were large numbers feeding in the evening, having appeared from nowhere about 5 p.m. On our return we found the country round Nimla and Jalalabad swarming with Sand Martins, old and young, sitting in long rows on the telegraph wires. We were unable to procure specimens.' (Meinertzhagen).

Sand Martins of the species *riparia* were obtained by Biddulph at Panjah, Wakkan on 17 April 1874 and at Kandahar on 5 April 1881 by Swinhoe who said they arrived in the latter part of March but not in any quantity. Yate obtained one at Karawal Khana, Badghis, on April 14.

A female obtained at Pushat by Griffith, who comments 'about rivers and sandbanks' is identified as probably of the typical race. Stuart Baker (*New Fauna*, vol. iii, p. 233) says that *Riparia riparia indica* breeds in Afghanistan.

The whole status and identity of the forms occurring in Afghanistan is evidently in need of revision.

Hirundo rustica rustica Linnaeus.

Specimens collected.—sex? Kabul, sex? Kussack (Griffith); ♂ 3 February 1881, ♂♂♀ 7 December 1881 Kandahar (Swinhoe); sex? 28 March 1885 Gulran, ♂ 26 April 1885 Toman-Agha (Aitchison); 2 sex? 12 April Kharawal Khan (Yate); ♂ 10 August 1833 Kabul (Maconachie); 3 ♂ 6 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The Common Swallow appears to breed throughout the greater part of Afghanistan but there is so much divergence between the different accounts of the bird that I have failed to bring them into correspondence with each other and therefore summarise them in the hopes that future observers will be able to arrive at the correct status of the bird.

In the Badghis according to Aitchison the Swallow was very common and remained the whole winter; whenever a storm came the birds used to seek the shelter of the Commission's tents in large numbers.

'At Danaghori a good few were nesting. At Haibak and Kunduz they were breeding freely in buildings in May, and on our return journey we found them breeding in Kabul. At Baghlan they were breeding freely on 22 May, in nearly all cases birds sitting on eggs. We were informed that the same nests are used year after year.

'The country immediately west of Jalalabad seemed a favourite breeding ground for Swallows for on 31 May we saw hundreds of old and young.

'Passage was noted at Jalalabad on 3 April at 11 a.m., at Kabul between 8 and 11 April in the mornings, at Bamian on 21 and 22 April at noon. In every case migratory flight was directed in a due northerly direction.' (Meinertzhagen).

In Southern Afghanistan generally the Swallow is evidently a summer visitor. In Seistan in 1934 Cumming found that they began laying in the last week of March, nesting in any building to which they had access. In 1905 the first Swallow was noted in the mission camp on 14 March but cold weather setting in again most of the birds disappeared and he found no nests.

At Kandahar Hutton, St. John and Swinhoe agree that they were summer visitors. Hutton gives their earliest dates for 1840 and 1841 as 8 February and 5 February respectively and says that they leave again in October. He points out that their arrival and departure is to some extent retarded or expedited by the weather though he has seen Swallows on the wing when the thermometer was as low as 36°. St. John gives his first date for 1879 as 7 February but says they disappeared before the end of September, very few indeed remaining after the middle of August. Swinhoe in 1881 saw his first Swallow as early as 29 January and 5 days later another flew into his room which proved to be a male with enormously swollen testes. A week later they were in thousands nesting in every suitable spot, the number in the city being very remarkable.

Koelz obtained specimens at Baghlan (July), Mamakhal and Laghman (May), Charakar and Gardez (June) and Girishk (Oct. 27). On these he bases a new race *Hirundo rustica afghanica* (Proc. Biol. Soc. Washington, vol. 52, 5 June 1939, p. 75—type locality Baghlan) but it is evident from the description that he was merely misled by the normal variation in the colour of the lower plumage of this species.

[**Hirundo rustica gutturalis** Scopoli.

This race is stated in the *New Fauna* (vol. iii, p. 242) to breed in Afghanistan but I do not find any evidence to that effect.]

Hirundo smithii filifera Stephens.

Specimens collected.—1 ♂ 2 ♀ 3 May Doshi 2,750 ft., 2 ♂ 18 May 1937 Baghlan 2,000 ft. (Meinertzhagen).

The Wire-tailed Swallow is perhaps only a summer visitor in Afghanistan. Griffith, according to his Journals, met with it at Ghazni, Kandahar, Mookhloor (15 July 1839), the Sorkhab River (9 Oct. 1839) and on the Helmund near Girishk. St. John says that he met with it on several occasions in the Arghandab Valley and once near Kelat-i-Ghilzai 5,000 ft.

Meinertzhagen first met with this swallow at Doshi 2,750 ft. on 3 May. They were breeding there and at Danaghori on 4 May, and Baghlan on 19 May and again about 30 miles south of Khanabad on 20 May, but the distribution is clearly very local.

Hirundo rufula scullii Seebohm.

Specimens collected.—♂ 21 June, 1934 Logar 5,700 ft. (Maconachie); ♂ 15 April Ghorband 6,500 ft., ♂ ♀ 4 May Doshi 2,500 ft., ♂ 4 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

Meinertzhagen found the Red-rumped Swallow building in the Ghorband Valley at 7,000 ft. on 15 April. It was nesting in stone bridges near Danaghori and in culverts under the road at Doshi. A slight passage was noted at Danaghori on 7 and 8 May.

To this form presumably belong the Swallows noted by Wardlaw-Ramsay in the Hariab Valley at 7,000-8,000 ft. and the small flock seen near Kach in 1881 by St. John though he failed to produce a specimen.

Motacilla alba dukhunensis Sykes.

Specimens collected.—2 sex? Afghanistan (Griffith); ♂ 24 April 1874 Panjah (Biddulph); ♀ Dec. 1880, ♀ 30 January, ♀ 22 March 1881 Kandahar (Swinhoe); ♂ ♀ ♀ 13-21 March 1885 Gulram (Aitchison); sex? 15 December Maruchak, 2 sex? 3 March-4 April Chahar Shamba (Yate); ♂ 11 March 1896 Gazechah 2,400 ft. (Maynard); ♀ 30 April Ghorband Valley, ♀ 27 August Logar, sex? 13 November 1933 Kabul (Monachie), ♀ 20 April 1937 Bamian 8,500 ft. (Meinertzhagen).

Meinertzhagen says that the White Wagtail was abundant at Bamian for a few days about 20 April and again passing in flocks at Khanabad and Kunduz about 21 May. Hutton says that it is found at Kandahar in the spring months and Swinhoe and St. John agree that it is common in winter at that place. It is no doubt both a winter visitor and a passage migrant in Afghanistan.

Motacilla alba personata Gould.

Specimens collected.—sex? April 1874 Panjah (Biddulph); ♂ December 1880, ♀ 2 January, ♂ 1 February, ♂ 16 April 1881 Kandahar (Swinhoe): ♂ 7 March 1885 Gulran (Aitchison); ♂ Shorawak (Maynard); sex? 28 April 1905 Kuhak (Cumming); 2 ♂ 13 December 1918 Lab-i-Baring (Annandale); ♂ 12 July 1933 Panjshir 6,000 ft. (Maconachie); 6 ♂ 5-9 April Paghman, 7,500-8,000 ft., ♀ 11 April Kabul 5,000 ft., ♂ 27 April Doab 5,000 ft., ♀ ad. ♀ juv. 21 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

Meinertzhagen found the Masked Wagtail widely distributed and breeding throughout Northern Afghanistan (young on the wing at Kunduz in late May) and Wardlaw-Ramsay found it breeding commonly in the Hariab Valley 7,000-8,000 ft. in May and June. He mentions newly-hatched young on 5 June and c/3 eggs in the same nest on 28 June. Maconachie's specimen from Panjshir 6,000 ft. was from the size of its organs also on its breeding ground.

Cumming's specimen from the banks of the Helmund opposite Kuhak on 28 April was in full breeding plumage but it may have been only on passage as in Southern Afghanistan this Wagtail seems to be only a winter visitor. Annandale found it very common in the desert and at that season both Swinhoe and St. John found it common at Kandahar.

Motacilla cinerea subsp.?

Specimens collected.—♀ 24 December, ♀ 16 January 1881 Kandahar (Swinhoe); sex? 28 April Chahar Shamba (Yate); ♂ 18 June Chahiltan 5,900 ft., sex? juv. 12 July 1933 Panjshir 6,000 ft. (Maconachie); 4 ♂ 1 ♀ 8 April Paghman 8,000 ft., ♀ 24 May 1937 Ghorband 8,300 ft. (Meinertzhagen).

Meinertzhagen found the Grey Wagtail common and breeding in suitable surroundings throughout his journey but not north or west of the Shibar Pass, though suitable country exists there. Pairs were building in the Paghman Valley in early April with snow on the ground and a nest with its first egg was found in the Ghorband Valley at 7,000 ft. on 15 April. Pairs were feeding young in the nest in the Ghorband and Paghman Valleys at the end of May. A single non-breeding pair at Haibak on 11 May were possibly on passage as may of course have been Yate's Chahar Shamba bird (28 April).

Maconachie's specimens from Chahiltan (18 June) and Panjshir (12 July) doubtless represent breeding birds and Wardlaw-Ramsay found the species common through the summer in the Hariab Valley 7,000-8,000 ft. where he found newly-hatched young on 5 June. Whitehead also says that it breeds freely along the streams of the Safed Koh from 6,000-8,000 ft. just across the boundary.

Further south at Kandahar Hutton says the bird was not uncommon during the autumn, winter and spring but St. John calls it a rare winter visitor.

The racial identity of Afghan birds has not been satisfactorily established.

Motacilla flava beema (Sykes).

Specimens collected.—♂ ♀ 25 April 1874 Panjah (Biddulph); ♂ 12 April, ♂ 20 April 1885 Tirphul (Aitchison); 3 ♂ 15-18 April Ghorband 8,200 ft., 2 ♂ 20 April 1937 Bamian 8,500 ft. (Meinertzhagen).

Sykes's Blue-headed Wagtail passes through Northern Afghanistan on the spring passage. Biddulph found it common in Wakhan in April. Aitchison obtained it at Tirphul in April. Meinertzhagen first saw it on 18 April in the Ghorband Valley at 8,200 ft. when a few arrived. There were many in the Shibar Pass on 19 April at 9,600 ft. and at Bamian they were abundant from 20 to 26 April, increasing towards the latter date. After that they were seen no more.

Motacilla flava thunbergi Billberg.

Specimens collected.—♀ 22 March, ♂ 26 March, ♂ ♀ 27 March, ♀ 3 April 1881 Kandahar (Swinhoe); 6 ♀ 11-19 March Gulran, 1 ♂ 2 ♀ 11-20 April 1885 Tirphul (Aitchison); sex? 5 September 1933 Jaskol 10,100 ft. (Maconachie); 2 ♂ 1 ♀ 20-24 April Bamian 8,500 ft., 1 ♂ 2 ♀ 1 May 1937 Barfak 3,500 ft. (Meinertzhagen).

The Ashy-headed Wagtail passes through Northern and Southern Afghanistan on spring and autumn passage. In addition to the above records Meinertzhagen says that he first met with it at Bamian on 24 April when a large flock were feeding in a flooded field. At Doab and Doshi they were common on passage during the first week in May and a large flock was seen at Kunduz on 20 May.

Motacilla feldegg melanogriseus (Homeyer).

Specimens collected.—♂ Kandahar (Griffith); sex? 17 April, ♂ 25 April 1874 Panjah (Biddulph); ♂ ♀ 26 February, 5 ♂ 4 ♀ 8-23 March 1881 Kandahar (Swinhoe); ♂ 27 March Khwaja Gogirdak (Yate); ♂ n.d. Lijjikarez 4,000 ft. (Maynard); ♂ 3 Sept. 1933 Sar-i-Chashma 9,000 ft. (Maconachie).

The Black-headed Wagtail evidently passes through Afghanistan on the spring passage—but perhaps with a more southern route than the last two species—as Hutton, St. John and Swinhoe found it common then at Kandahar. St. John adds that a few remain to breed about Kandahar but this appears unlikely. Stoliczka also had an idea that they bred in the Wakkan. Meinertzhagen believed that he saw a small flock at Bamian on 24 April.

That the Black-headed Wagtail occurs on the autumn passage as well is evident from Maconachie's specimen obtained at Sar-i-Chashma 9,000 ft. on 3 September.

Motacilla citreola weræ Buturlin.

Specimens collected.—[♂♀] Pushut (Griffith); 4 ♂ 2 ♀ 17-26 March, ♀ 8 April 1881 Kandahar, ♀ 1 May 1881 Gungazai (Swinhoe); 2 ♂ 19 March 1885 Gulran, ♂ 12 April Tirphul, ♂ 16 April 1885 Khusan (Aitchison); a sex? 28 April Chahar Shamba (Yate); ♀ Lijjikarez (Maynard); ♂ 6 August 1933 Baqrami 5,700 ft. (Maconachie); 2 ♂ 18 April Ghorband 8,200 ft., ♂ 27 April 1937 Doab 5,000 ft. (Meinertzhagen).

The Grey-backed Yellow-headed Wagtail evidently passes through Maimanah and Badghis on the spring migration as Swinhoe and St. John say is the case at Kandahar where it is common. Meinertzhagen found Wagtails of this type fairly common on passage in the Ghorband Valley in mid-April and again still more abundant at Bamian about 24 April. He attributes his specimens to the typical race.

Motacilla citreola calcarata Hodgson.

Specimens collected.—♂ 20 March ♂ 26 March 1881 Kandahar (Swinhoe); sex? 12 April 1933 Baqrami 5,700 ft. (Maconachie); ♂ 24 April Bamian 8,500 ft., ♂ 28 April Doab 5,000 ft., ♂ 23 May 1937 Shibar Pass 8,500 ft. (Meinertzhagen).

Meinertzhagen first saw Hodgson's Yellow-headed Wagtail at Bamian but it was never common. He says that it is apparently a summer visitor, breeding in suitable localities in the Bamian and Ghorband Valleys. Maconachie notes that 'Yellow Wagtails'—amongst which must evidently be included this species —appear in thousands in the Kabul marshes in April. It is also common on spring passage at Kandahar according to Swinhoe while St. John states that a few remain to breed there.

Anthus trivialis trivialis Linnaeus.

Specimens collected.—♂ 23 April 1874 Panjah (Biddulph) ♂ 2 April 1881 Kandahar (Swinhoe); ♀ 3 September 1933 Paghman 6,500 ft., ♂ 2 April ♂ 30 April 1934 Kabul 5,700 ft. (Maconachie); 3 ♂ 4-11 April Kabul 6,000 ft., 2 ♂ 8 April Paghman 7,000 ft., 1 ♂ 4 ♀ 20-24 April 1937 Bamian 8,500 ft. (Meinertzhagen).

Meinertzhagen found the Tree Pipit common on passage round Kabul, in the Ghorband Valley and at Bamian from 4-26 April after which date none were seen. The other specimens listed above would also seem to have been on spring passage and I find difficulty—in view of the status of this bird in North-west India—in understanding Swinhoe's statement that the Tree Pipit is common throughout the winter at Kandahar.

Anthus trivialis haringtoni Witherby.

Specimens collected.—sex? 'Himalayas' (Griffith); ♀ 11 April 1937 Kabul 5,800 ft. (Meinertzhagen).

Griffith's specimen, now in the British Museum, would seem according to his Journal to have been collected at Pashat on 25 February 1840 but it must be accepted with reserve.

To this race may also have belonged the pair of Tree Pipits which Wardlaw-Ramsay says he saw in the Hariab district on 5th May, securing the female.

[**Anthus hodgsoni hodgsoni** Richmond.

I can find no corroboration for the statement in the *New Fauna* (vol. iii, p. 281) that the Indian Tree Pipit breeds in Afghanistan. It appears unlikely.]

Anthus sordidus jerdoni (Finsch).

Specimen collected.—♂ 31 May 1937 Jagdalak near Jalalabad (Meinertzhagen).

Meinertzhagen only obtained the one specimen of Brown Rock Pipit in Afghanistan and that he identified clearly as *jerdoni*.

Anthus sordidus decaptus Meinertzhagen.

Specimens collected.—♀ 22 June 1879 Shaluzan (Wardlaw-Ramsay); ♀ 23 June 1879 Kandahar (St. John).

Wardlaw-Ramsay says that he found this race of Brown Rock-Pipit common on the slopes of the Safed Koh where he took c/3 eggs on 22 June. I have examined both the above specimens in the British Museum and they cannot be separated from Baluch specimens.

Anthus rufulus waitei Whistler.

Specimen collected.—♀ 26 April 1881 Gatai (Swinhoe).

The above specimen and St. John's statement that he got the Indian Pipit at Kandahar in June provide the only records for Afghanistan. It is doubtless a summer visitor.

Anthus campestris campestris (Linnaeus).

Specimens collected.—2 ♂ 4 April Kabul 6,000 ft., ♂ 19 April 1937, Bamian 8,500 ft. (Meinertzhagen).

Meinertzhagen states that the typical race of the Tawny Pipit was not uncommon on passage round Kabul on 4 April and a single bird at Bamian on 19 April. A female in the British Museum (wing 93 mm.) obtained by St. John at Kelat-i-Ghilzai is—if correctly sexed—evidently of the same form.

Anthus campestris griseus Nicoll.

Specimens collected.—sex? April 1874 Panjah, Wakkan (Biddulph); ♂ 23 March, ♀ 3 April Kandahar, ♀ 25 April Dubrai, ♀ 25 April 1881 Gatai (Swinhoe); ♀ 19 March Gulran, ♂ 6 April Tirphul, 2 ♀ 16 April 1885 Khusan (Aitchison); ♂ 2 April 1934 Kabul 5,700 ft. (Maconachie); ♀ 23 April Bamian 8,500 ft., ♀ 30 April Doab 5,000 ft., ♂ 11 April Tash Kotal 3,800 ft., ♂ 16 May 1937 Haibak 3,000 ft. (Meinertzhagen).

Meinertzhagen found the Tawny Pipit breeding at Tash Kotal and Haibak and took a nest with 5 eggs at the latter place.

In Southern Afghanistan it is evidently a common winter visitor according to Swinhoe and St. John. The other records probably refer to passage birds.

Anthus cervinus (Pallas).

Specimens collected.—sex? 16 April 1874 Panjah (Biddulph); 2 ♂ 6 April 1937 Kabul (Meinertzhagen).

These are the only records of the Red-throated Pipit in Afghanistan, doubtless on passage. Meinertzhagen's birds were feeding on irrigated meadow-land.

Anthus roseatus Blyth.

Specimen collected.—sex? 10 March Maruchak (Yate).

This is the only record of Hodgson's Pipit for Afghanistan but Whitehead says it breeds freely on the Safed Koh from 11,000-13,000 ft. in June.

Anthus spinoletta blakistoni Swinhoe.

Specimens collected.—♂ ♂ ♀ 12-18 December 1880, 3 ♂ 8-18 January, ♀ ♂ 12-13 March 1881 Kandahar (Swinhoe); ♀ 17 January 1885, Bala-Morghab, 2 ♀ 19 March 1885 Gulran (Aitchison); 5 sex? 3-22 February Chahar Shamba (Yate); 2 sex? 10-14 March 1934 Chaharasia (Maconachie).

The Water Pipit is probably a passage migrant and winter visitor. Swinhoe and St. John's statements that it is very common in winter in the Kandahar district supplements the above records.

Anthus spinoletta japonica Temm. & Schl.

Specimen collected.—♀ 9 April 1937 Paghman 8,000 ft. (Meinertzhagen).

Probably a straggler. It will be remembered that Whitehead obtained four specimens (January to April) at Kohat where it was a somewhat scarce winter visitor.

Oreocorys sylvanus (Blyth).

Specimen collected.—♂ 19 July 1933 Andarab-Banu 4,000 ft. (Maconachie). The only record of the Upland Pipit for Afghanistan.

Alæmon alaudipes doriæ (Salvadori).

Specimens collected.—♀ 26 September 1879 20 miles N.-E. of Kandahar 4,000 ft. (St. John); ♂ 5 November 1884, Zagin (Aitchison); ♂ 21 September 1904, Kuhak (Cumming); ♀ Chandan Band, ♀ Lora Hamun (Maynard).

Cumming says that the Desert-Lark is a resident on the gravel-strewn 'dashts' of Seistan where it is usually seen singly or in pairs, though family parties may be seen together in September. The above records show that it is also found throughout Southern Afghanistan generally.

Eremophila alpestris albigulæ (Bonaparte).

Specimens collected.—♂ ♀ 25 January 1881 Kandahar (Swinhoe); 3 ♂ 2 ♀ 14-23 April Panjah, Wakkan (Biddulph); ♂ 19 October 1934, Karganathu 10,200 ft., ♂ ♀ 6 January 1935 Musai 5,800 ft. (Maconachie); 9 ♂ 4 ♀ 19 April Shibar Pass 9,800 ft., ♂ 25 April Bamian, 11,600 ft., 4 ♂ 3 ♀ 25 May Shibar Pass 9,800 ft., ♂ ♀ 29 May 1937, Unai Pass 1,200 ft. (Meinertzhagen.)

Meinertzhagen says that the Horned Lark is confined to the flat tops of the Hindu Kush above 9,000 ft. in the breeding season and that wherever it occurs it is common. In winter it drops to lower levels as at Musai where Maconachie obtained specimens at 5,800 ft. and it also moves south into Southern Afghanistan where Swinhoe and St. John found it an uncommon winter visitor.

[**Eremophila alpestris longirostris** (Moore).

I can find no authority for the statement in the *New Fauna* (vol. iii, p. 309) that this form occurs in Afghanistan].

Melanocorypha calandra psammochroa Hartert.

Specimens collected.—2 ♂ 1 juv. 19 May 1937, Khanabad, 1,800 ft. (Meinertzhagen).

Meinertzhagen says of the Calandra Lark:—met with only in Afghan Turkestan, some ten to fifteen miles south of Khanabad, in crops and grass land between 1,300 ft. and 1,600 ft. Not met with elsewhere. Young were on the wing (in May) but males were still singing and soaring.

Melanocorypha bimaculata bimaculata (Menetries).

Specimens collected.—2 sex? Pashat (Griffith); ♂ 15 October Kelat-i-Ghilzai (St. John); 2 ♀ 6 February, ♂ 8 February 1881, Kandahar (Swinhoe); ♂ ♀ 8 November between Sangbar and Karez-dasht, ♂ 15 November Zind-i-jan, ♀ 28 November between Asia-deh and Kar-o-bagh, ♂ 1 December 1884 between Aftao and Kara-Kainta, ♂ ♀ 17 January 1885 Bala-Morghab, ♀ 17 February 1885, between Mara-chak and Ab-i-goshan, 4 ♀ 9-18 March 1885, Gulran (Aitchison); 2 sex? 17 March Maruchak, sex? 27 March Khwaja Gogirdak (Yate); ♂ 25 April Bamian 8,500 ft., ♂ ♀ 18 May 1937 Tash Kotal 4,300 ft. (Meinertzhagen).

Meinertzhagen states that the pair collected at Tash Kotal were undoudbtedly breeding. The Eastern Calandra Lark would seem however, to be in the main a winter visitor and passage migrant, as suggested by the above specimens.

At Kandahar Swinhoe was informed by the local bird-catchers that it arrived in October and left at the latter end of March.

Griffith, however, recorded in his Journal at Pashat 26 February 1840 that the Calandra had just come in in abundance and at Bala Chugar Serai under 9 March 1940 he again records that it had just come in there and comments on the supposed difference of 12 to 14 days in the dates of arrival at two places about 18 miles apart. These no doubt were passage migrants returning from their winter quarters in the Punjab.

In Afghanistan, as in Kashmir, the Calandra is a favourite cage bird.

Alauda arvensis intermedia Swinhoe.

Specimens collected.—5 specimens Pushut (Griffith); 3 specimens 23-25 April 1874 Panjah, Wakkan (Biddulph); ♂ 2 February, ♂ 8 February 1881, Kandahar (Swinhoe); ♂ 1 February 1884, ♂ 12 December Aftao (Aitchison).

The Skylark is a common winter visitor to South-east Afghanistan in the Kandahar province according to St. John, but Swinhoe appears to doubt whether it arrives before February in which case it may be only a passage migrant.

Alauda gulgula inconspicua Severtzov.

Specimens collected.—♀ 7 April, ♂ May 1879, Kandahar (St. John); ♂ 20 March, ♀ 30 March, ♂ 31 March 1881, Kandahar, ♀ 26 April 1881, Dubrai (Swinhoe); ♀ 30 August 1933 Kabul, ♂ 22 May 1934, Kabul 5,700 ft. (Maconachie); 3 ♂ 1 ♀ 5-6 April Kabul 6,000 ft. 2 ♀ 20-26 April Bamian 8,500 ft., 3 ♂ 1 ♀ 5-7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The Little Skylark was found by Meinertzhagen at Khanabad, Haibak and Danaghori and Kabul in May in circumstances that can leave no doubt that it was on its breeding ground. It had been in small parties on cultivated ground at Kabul and Bamian in the first half of April.

It also breeds in some numbers about Kandahar according to Swinhoe and St. John, and in the Hariab Valley 7,000-8,000 ft. according to Wardlaw-Ramsay. Opinions differ however as to whether it is a resident or a summer visitor.

Meinertzhagen draws a distinction between his specimens, calling those from Danaghori true *inconspicua* and those from Bamian and Kabul as inseparable from *gulgula* but with a slight tendency towards *inconspicua*. *Inconspicua* is however itself so poorly defined a race (vide Ticehurst, *J.B.N.H.S.*, xxxi, p. 873) that it is hardly worthwhile drawing a distinction within the country.

Calandrella acutirostris Hume.

Specimens collected.—sex? 16 April 1874, Panja, Wakkan (Biddulph); sex? 4 May 1879 Byan Khel (Wardlaw-Ramsay); 2 ♂ 20 June 1934 Ghazni road, Kabul; ♂ 19 April, 5 ♂ 5 ♀ 23-25 May, Shibar Pass, 9,800 ft., ♀ 24 May Ghorband 8,300 ft., 2 ♂ 29 May 1937 Unai Pass 1,200 ft. (Meinertzhagen).

Meinertzhagen found that Hume's Short-toed Lark bred abundantly on the high flat tops in Northern Afghanistan. When he crossed the Shibar Pass on 19 April he saw only a single bird, but on the return journey on 23 May it was extremely abundant on the same ground and laying was in full swing. He recorded an interesting note on the courtship behaviour. They were equally common and breeding in the Unai Pass at the end of May.

Biddulph's Panja bird may well have been also on its breeding ground. Under the name of *brachydactyla* Wardlaw-Ramsay says that the Short-toed Lark was found in small parties in the Hariab Valley until the end of May after which they were not observed. The above specimen in the British Museum is *acutirostris* and it was evidently on passage at Byan Khel. The winter quarters of this form have not been very accurately worked out.

Calandrella brachydactyla longipennis (Eversmann).

Specimens collected.—2 sex? Afghanistan (Griffith); ♂ ♀ March 1879, Kandahar (St. John); ♂ ♀ sex? 7 March, ♀ 9 March, ♀ 12 March, ♂ 30 March 1891, Kandahar (Swinhoe); 2 sex? 17 March Maruchak, Badghis, sex? 27 March Khwaja Gogirdak, Murghab (Yate); 2 ♂ 11-15 March Gulran, 2 ♂ 7-13 April 1885, Tirphul (Aitchison), 2 ♀ 11 April Kabul 6,000 ft., ♂ ♀ 26 April Bamian 8,500 ft., 2 ♀ 7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

I have not been able to see all the above specimens to verify that they belong to this race of Short-toed Lark but it evidently occurs in enormous numbers on both the spring and autumn passages in the Kandahar area according to both St. John and Swinhoe. Meinertzhagen found it common on passage at Kabul in mid-April and a good many small flocks were seen at Bamian towards the end of April. He had previously seen a few at Jalalabad on 4 April.

It may breed at Danaghori where he located two pairs on the short turf of the great plain. The females had the ovaries ripe for laying.

Swinhoe in 1881 remarked on the large numbers of this lark netted by the Afghans for eating at Kandahar and Meinertzhagen in 1937 still found them being sold in huge numbers at Kabul.

Calandrella rufescens persica (Sharpe).

Specimens collected.—3 sex? Afghanistan (Griffith).

The above specimens are in the British Museum but there is no other information about the Lesser Short-toed Lark in Afghanistan.

Galerida cristata magna Hume.

Specimens collected.—4 sex? Pushut (Griffith); sex? October 1879, Khelat-i-Ghilzai (St. John); ♀ 15 December 1880, 2 ♂ 1-2 February, ♂ 2 ♀ 21 February, ♀ 6 April 1881 Kandahar, 2 ♂ 24 April 1881 Melkarez (Swinhoe); sex? 4 January, sex? 26 January Chahar Shamba (Yate); ♀ 19 January Bala-Morghab, ♂ 7 March, ♂ 12 March Gulran, ♀ 6 April 1885 Tirphul (Aitchison); ♂ 20 April 1905, Kuhak (Cumming); sex? 13 December 1918, Lab-i-Baring (Annandale); ♂ 2 April 1934, Kabul (Maconachie); 4 ♂ 3 ♀ 4-7 April Kabul 6,000 ft., ♂ 1 May Barfak 3,500 ft., 3 ♂ 1 juv. 4 May Doshi 2,500 ft., ♂ 11 May, Tash Kotal 2,300 ft., ♂ 8 May, Danaghori 2,300 ft., 2 ♂ 1 ♀ 11-15 May Haibak 3,000 ft. ♂ 21 May 1937, Kunduz 1,800 ft. (Meinertzhagen).

The Crested Lark appears to be very generally distributed and resident throughout Afghanistan up to about 6,000 ft. in the Kabul area and up to 3,000 ft. in Northern Afghanistan. According to Cumming the breeding season in the Helmund area is from March to June.

About Pushut this form would seem to grade into *G. c. chendoola* of India as of 4 birds of Griffith's from that locality three would certainly pass as *chendoola*.

Ammomanes phœnicura zarudnyi Hartert.

Specimen collected.—sex? 14 December 1915, Lab-i-Baring (Annandale).

There is no other record of the Rufous-tailed Finch-Lark. This specimen was compared at Tring and identified by Mr. Stuart Baker.

Ammomanes deserti orientalis Zarudny and Loudon.

Specimens collected.—♂ ♀ 27 April, Doab 5,000 ft., ♂ ♀ 23 May, Barfak 3,000 ft., ♀ 17 May 1937, Haibak 3,000 ft. (Meinertzhagen).

Meinertzhagen states that the above specimens represent practically all that he saw of this form of Desert Lark. They were always on rocky ground at the foot of steep slopes.

Ammomanes deserti phœnicuroides (Blyth).

Specimens collected.—sex? Pushut (Griffith); 2 ♂ 1 ♀ March-May 1879 Kandahar (St. John); ♂ ♀ 5 January Kandahar, ♀ 24 April Malkarez, ♀ 25 April 1881, Dubrai (Swinhoe); ♂ 24 April 1905 Khawaja Ahmed (Cumming). ♂ 20 May, sex? 24 May 1934, Kabul 5,700 ft. (Maconachie); 3 ♂ 1 ♀ 4-6 April 1937, Kabul 6,000 ft. (Meinertzhagen).

The Desert Lark is common and doubtless resident over the greater part of Afghanistan. Farther north it is also resident but less common round Kabul and the Lower Ghorband Valley, also towards Pushut, confining itself to bare slopes and waste ground of a sandy nature from 7,500 ft. downwards.

As pointed out by Ticehurst (*J.B.N.H.S.*, xxxi, p. 876) these Afghan birds are not quite typical being really intergrades between *phoenicuroides* and *iranica*, resembling the latter particularly in size.

Zosterops palpebrosa remota Koelz.

Specimens collected.—6 sex? 18 December 1937, Jalalabad.

The White-eye has only been recorded by Koelz who separated his series from Jalalabad as a new race (Proc. Biol. Soc. Washington, vol. 52, 5 June 1939, p. 76). I have not seen any of his series but find difficulty in believing that they can be really separable from *Z. p. occidentis* which is so common in the north-west corner of the Punjab into which the Kabul River drains.

Cinnyris asiatica brevirostris (Blanford).

The *New Fauna* (vol. iii, p. 399) says that the Purple Sunbird is found in Afghanistan but I have not been able to find any details of the status and distribution beyond the fact that Koelz obtained a small series at Kalaigulaman.

Picus squamatus squamatus Gould.

Specimens collected.—♀ Chughur Serai (Griffith); ♂ 10 December 1933 Logar 3700 ft. (Maconachie); ♀ June 1935 Gardez Forest (Blanchard).

The only records of the typical race of the Scaly-bellied Green Woodpecker. It should however occur along the Safed Koh as Whitehead found it fairly common in winter in the Kohat District.

Picus squamatus gorii (Hargitt).

Specimen collected.—♂ 26 Oct. 1884 between Padda-Sultan and De-Kamrun, Lower Helmund (Aitchison).

The above specimen which is the type of the race was shot by Captain Gore, R.E., and is figured in plate vi of Aitchison's Report on the Zoology of the Afghan Delimitation Commission.

Dryobates himalayensis (Jardine & Selby).

Specimens collected.—♂ 5 May, ♂ 16 May, ♂ juv. 3 June 1879 Byan Khel (Wardlaw-Ramsay).

According to Wardlaw-Ramsay the Himalayan Pied Woodpecker is the only species of woodpecker to be found in the Hariab Valley 7,000-8,000 ft. about Byan Khel. He found it very abundant and breeding. Young had flown by the beginning of June. Whitehead found it common on the Safed Koh up to tree-limit.

Dryobates leucopterus leptorhynchus (Severtzow).

Specimens collected.—♀ 3 May Doshi 2,750 ft., 2 ♂ 4 ♀ 12-14 May Haibak 3,000 ft., ♂ 18 May 1937 Baghlan 2,000 ft. (Meinertzhagen).

'First met with at Doshi in the orchards on 3 May (2,750 ft.) and a few others seen. Apparently absent from Danaghori but at Haibak we found them abundant in the orchards and gardens in the middle of May. A single bird was seen at Baghlan but apparently absent from Kunduz' (Meinertzhagen).

Dryobates brunnifrons (Gould).

Specimen collected.—♀ Pashat (Griffith).

In addition to the above specimen which is in the British Museum, Griffith recorded in his Journal meeting with the Brown-fronted Pied Woodpecker at Bharowal on 7 March 1840. It may breed on the Safed Koh as it is a common winter visitor to the Kohat District.

Jynx torquilla torquilla Linnaeus.

Specimens collected.—♂ ♀ April 1879, Kandahar (St. John); ♀ 17 April 1881 Kandahar (Swinhoe); ♀ 30 April 1934 Logar 5,700 ft. (Maconachie); 6 ♂ 3 ♀ 20-25 April 1937 Bamian (Meinertzhagen).

The Wryneck is at present only known as a spring passage migrant through Afghanistan, but Meinertzhagen appears to be the only observer who has met with the birds in any numbers. On 20 April he saw 4 birds at Bamian which took refuge in a buckthorn hedge. On 24 April the Bamian Valley was literally overrun with Wrynecks, every available bush having its quota. When flushed they would often fly round and return to the same bush on finding all others occupied. Many were sitting about looking stupid and lost on the road or in the fields. It would have been easy to collect over 50 specimens in an hour. This rush passed on and a pair at Danaghori were the only others seen.

Cuculus canorus canorus Linnaeus.

Specimens collected.—♂ Jugdulluck, juv. Afghanistan, sex? Jalalabad, juv. Kabul (Griffith); ♀ 4 June 1934 Kabul (Maconachie); 4 ♂ 5-10 May Danaghori 2,300 ft., ♂ 24 May 1937 Ghorband 8,300 ft. (Meinertzhagen).

The Cuckoo has only been recorded from the north-east quarter of Afghanistan. Meinertzhagen first heard it at Doshi 2,750 ft. on 2 May and at Danaghori on 5 May there seemed to be a larger influx with much noise and chasing of each other, several females being noted. A hepatic female was seen 10 May. These Cuckoos were clearly ready to breed and the Great Reed Warbler appeared to be the most obvious host. Many Cuckoos were seen and heard at Kunduz, mainly over the extensive marshes, on 20 May. In June 1886 Yate found Cuckoos plentiful in the cultivation along the Oxus between Khamiab and Karkin (Northern Afghanistan, p. 245).

The specimens collected by Griffith and Maconachie suggest that it must breed in the Kabul area.

In the Hariab Valley 7,000-8,000 ft. Wardlaw-Ramsay says that it arrived about the beginning of May though he heard his first bird personally on 15 May. It became exceedingly abundant. On the Safed Koh, Whitehead observed it up to tree limit where it was calling till well past the middle of July.

Further south Griffith in his Journal mentions the Cuckoo calling on the Khojak Pass (just over the boundary) on 12 April though Swinhoe had not heard it at Kandahar up till his departure on 22 April.

Meinertzhagen attributes three of his Danaghori specimens to the race *subtelephonus* but I doubt whether it is worth recognition.

Coracias garrula semenowi Loudon & Tschusi.

Specimens collected.—4 sex? Kandahar (Griffith); ♂ May Kandahar (St. John); ♂ ♂ 17-18 April 1881 Kandahar, sex? 21 April 1881 Melkarez, ♂ 23 April 1881 Abdul Rahim (Swinhoe); ♂ ♂ ♀ 13 April 1885 Tirphul, ♀ 16 April 1885 Gulran, ♀ 19 May 1885 Kambao (Aitchison); 3 sex ? 30 April—1 May Chahar Shamba, sex ? 1 June Min Darakht, Maimanah (Yate); ♀ 10 March 1896 Robat 4,100 ft. (Maynard); sex ? May 1903, ♂ 24 April 1905 Khwaja Ahmed (Cumming); ♂ 16 July 1933 Deh Saleh, ♂ 10 August 1933 Tezim Valley 25 m. E.S.E., of Kabul. sex ? 4 Sept. 1933 Onai Pass (Maconachie); ♂ 1 May 1937 Doshi 2,750 ft. (Meinertzhagen).

The Kashmir Roller is an abundant summer visitor to Afghanistan where Meinertzhagen says its distribution is governed by altitude—scarce above 5,000 ft. and common below that elevation. With this provision it seems to be common everywhere and there is no need to cite the records in detail. The earliest date on which it has been recorded is 10 March at Robat 4,300 ft. (Maynard) but the majority arrive in April and Swinhoe gives 4 April as his earliest date for Kandahar.

The Roller must necessarily be also a passage migrant through Afghanistan and Cumming records that on 24 April 1905 at Khwaja Ahmed the country was swarming with them on passage, travelling in a northerly direction.

[**Coracias benghalensis** Linnaeus.

Wardlaw-Ramsay thought that a Roller which was not very common in the Hariab Valley 7,000-8,000 ft. in May was this species and not *Coracias garrula*, though I should certainly have expected the latter to occur there.]

Merops apiaster Linnaeus.

Specimens collected.—2 ♂ June Byal Khel ((Wardlaw-Ramsay); ♂ ♀ 14 April 1881, ♂ ♂ ♀ 17 April 1881 Kandahar (Swinhoe); ♂ 16 April Khusan, ♀ 20 April Tirphul, ♂ 28 April Kambao, ♀ 3 May 1885 Shore-Kaltegai (Aitchison); 4 sex ? 29 April-1 May Chahar Shamba, sex ? Minar Shadian (Yate); ♂ 25 May 1933 Kabul (Maconachie); ♂ 13 April Kabul 5,800 ft., 2 ♂ 2 ♀ 14 April 1937 Cherikar 5000 ft. (Meinertzhagen).

The Common Bee-eater is a summer visitor to Afghanistan where it breeds in considerable numbers at moderate elevations. Aitchison found it breeding in the Hari-rud area and Meinertzhagen at Doshi, Danaghori, Haibak and Kunduz, but although Hutton says it arrives at Kandahar in the beginning of April and leaves in the beginning of autumn St. John and Swinhoe do not actually clear up the point whether it breeds in that area or not. It must of course be a passage migrant through Afghanistan as well as a summer visitor, and Hutton may have been referring to this.

This Bee-eater arrives in Afghanistan, usually before *M. s. persicus*, about the middle of April. Meinertzhagen says he heard it passing over Kabul on the evening of 11 April and a flock of eight were seen near Kabul on 13 April. A large flock were resting on telegraph wires at Cherikar on 14 April. Aitchison procured a specimen at Khusan on 16 April. Swinhoe first met with the species at Khandahar on 14 April when a large flock were flying round and round some large trees in a garden outside the Herat Gate.

In the Hariab Valley 7,000-8,000 ft. Wardlaw-Ramsay says that he first observed this species on 5 June after which it became quite common. He goes on to say that on 22 June he found it very common just across the border between the Kurram Fort and the Peiwar Kotal where neither trees nor shrubs were to be seen for miles. Up till 10 July when he left the Kurram Valley these birds were not breeding. These statements are presumably connected with an observation made by Whitehead who remarks that towards the end of July, when nesting operations were over, flocks of from ten to forty birds used to fly up the valleys of the Safed Koh to tree limit (12,000 ft.) every morning and return at dusk. Local feeding movements or the preliminary movements of young birds are presumably involved.

Merops superciliosus persicus Pallas.

Specimens collected :—2 sex ? Afghanistan (Griffith); ♂ ♀ May 1879 Kandahar (St John); ♀ 28 April Tomam-Agha, Hari-Rud, ♂ 28 April between Tomam-Agha and Kambao, ♂ 13 May 1885 Kumani-Besht (Aitchison); sex? 22 April 1905 Kuhak (Cumming); 4 ♂ 8 May 1937 Danaghori 2300 ft, (Meinertzhagen).

Griffith records the Blue-cheeked Bee-eater in his Journal on several occasions, viz. :—Gundamuck 5 June 1840, Chuqur Pir 19 March 1840, Arghundee 6 August 1839, Kabul 5 June 1840, Shah Bagh 24 July 1840.

This Bee-eater is like the last a summer visitor to Afghanistan but it appears to be confined as a breeding species to the lowest elevation in the country and largely to the neighbourhood of rivers and marshy ground. Meinertzhagen describes large breeding colonies in the swampy plains of Danaghori and at Kunduz and Jelalabad. Cumming found it very numerous and nesting in Seistan. Hutton and St. John found it about Kandahar.

According to Cumming it arrives in Seistan from a westerly direction in April—earliest date in 1905 17 April—and leaves about October. Other observers say that it arrives rather later than *M. apiaster*. Meinertzhagen noted the first arrivals at Danaghori on the early morning of 7 May, the birds being quite common by the next day.

Wardlaw-Ramsay (Ibis 1879, p. 446) records a marked passage of Bee-eaters at Byan Khel. Numbers arrived on 30 April and the following day but disappeared as rapidly as they came. They were flying at a considerable height and travelling apparently in a north-westerly direction. He seems at first to have been doubtful of their identity but later (Ibis 1880 p. 49) he assigns them definitely to this species.

Merops orientalis Latham.

The Little Green Bee-eater has only been recorded by Meinertzhagen who observed it twice on telegraph wires at the Indo-Afghan frontier post Torkham on 1 April, and near Jelalabad on 31 May.

Ceryle rudis afghanistanica Koelz.

Specimens collected :—3 ♀ 26 May 1937 Laghman (Koelz).

A specimen from Jalalabad, February 1840, is noted in the Worcester MS. list in the British Museum. One of the above females is the type of Koelz's new race. I have not examined Afghan birds but as these are from the Kabul River Valley they are hardly likely to differ from Punjab birds which like other Indian birds agree with *C. r. leucomelanura* from Ceylon.

The only other record is St. John's statement that the Pied Kingfisher was noted occasionally at Kandahar but is very rare.

Alcedo atthis pallasii Reichenbach.

Specimens collected.—2 ♂ 1 ♀ Feb.-April 1879 Kandahar (St. John); 2 ♂ 20-22 Dec. 1880, ♂ ♀ 9-24 1881 Kandahar (Swinhoe); ♀ 28 June 1933 Logar 5,700 ft., sex? 12 Sept. 1933 Band-i-Amir 9,300 ft. (Maconachie); ♂ ♀ 21 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

In addition to the above records we have the statements of Cumming, Hutton, St John and Swinhoe that the Kingfisher is common and resident all over Seistan and the Kandahar area. Meinertzhagen also met with it in the Ghorband Valley at 8,200 ft. The latter does not agree that *pallasii* is a recognisable race—at best it appears to me a poor one—and attributes his skins to the typical race.

Halcyon smyrnensis Linnaeus.

The White-breasted Kingfisher is only recorded from Afghanistan by Griffith who saw it at Khoonee near Pashat on 31 March 1840.

Upupa epops epops Linnaeus.

Specimens collected:—sex? Kabul (Griffith); ♂ 14 Feb. 1879, ♂ 4 March 1879 Kandahar (St. John); sex? Dec. 1880, ♂ 1 Feb. 1881, ♂ 16 April 1881 Kandahar (Swinhoe); 2 ♂ 7-12 March 1885 Gulran (Aitchison); sex? 6 March Maimanah Chul (Yate); ♀ 27 Feb. 1896 Sahibzada 3,000 ft. (Maynard); ♀ 9 August 1933, ♂ 9 May 1934 Kabul 5,700 ft. (Maconachie); ♀ 4 April Kabul 6,000 ft., 2 ♂ 18 April 1927 Ghorband 8,200 ft. (Meinertzhagen).

Griffith mentions the Hoopoe in his Journal at Ghazni (24 July 1839), Arghandhi (very common 6 August 1839), Bharowal (15 April 1840) and Shah Bagh (24 July 1840). It is evidently a summer visitor to the greater part of Afghanistan, breeding up to at least 9,000 ft. Meinertzhagen found it breeding at Doshi, at Danaghori and at Haibak, near the Shibar Pass at 9000 ft. and in the Paghman Valley at 8000 ft. In Kabul he found that most gardens seemed to contain a pair. Wardlaw-Ramsay says it was breeding in June in the Hariab Valley 7,000-8,000 ft. near Byan Khel. Cumming says he saw several in Seistan hanging about holes in walls during the summer months. At Kandahar Hutton called it only a summer visitor and considered it scarce. Both Swinhoe and St. John, however, say that it is common everywhere and the former added that he believed it to be a permanent resident. That some birds, at least, are found at Kandahar in winter is clear from his December and January specimens and it will be noted that Maynard obtained a specimen at Sahibzada on 27 February.

The Hoopoe is also, doubtless, a passage migrant through Afghanistan. Griffith, as noted above, found it very common at Arghandhi on 6 August. Meinertzhagen saw the first bird near Kabul on 4 April. On the 18 April at 8,200 ft. in the Ghorband Valley he was lucky enough to witness an actual movement at 6 p.m., or just before sunset. There was a bitter cold wind blowing from the west with sleet in the air. Two parties of about fifty birds each passed towards the north, flying some 400 ft. above the ground. They were in very loose formation and being badly buffeted about by gusts of wind.

Micropus melba tuneti (Tschusi).

Specimens collected:—sex ? Murghab, Herat (Yate): ♂ ♀ 10 April Kabul 5,500 ft.; ♀ 6 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

Meinertzhagen who identifies his specimens as belonging to this pale form says that 'the Alpine Swift would appear suddenly from nowhere and as quickly disappear often at a great height and always with great speed. At Kabul in the afternoon a large party would come and feed over a small lake too near the city for shooting with safety. At Bamian a single bird appeared on 22 April and took great interest in the caves and rock dwellings entering and remaining in them for considerable periods. Two were seen at Doab on 29 April and many were circling about a high cliff entering crevices and perhaps breeding. On 5 and 7 May a few were feeding over the meadows at Danaghori and from the state of their organs were breeding in the neighbourhood. At Haibak a few were seen flying high over a mud fort on 11 May.'

St. John says that one specimen only was seen and shot at Kandahar. Unfortunately he has not recorded the date and I cannot trace the specimen in the British Museum. The Alpine Swift is a spring and autumn passage migrant at Kohat. No doubt the typical race must occur in Afghanistan.

Micropus apus pekinensis (Swinhoe).

Specimens collected.—♂ 10 April 1879 Kandahar (Swinhoe); ♂ 1 July 1879 Sufed Koh 12,600 ft. (Wardlaw-Ramsay); ♂ 17 February, ♀ 8 March 1881 Kandahar (Swinhoe); 2 sex? 12-17 April Karewal Khana, sex? 13 May Kilawali (Yate); ♂♀ 7 April Kabul 6,000 ft., ♂ 5 May 1937 Danaghori 2,500 ft. (Meinertzhagen).

The Common Swift breeds along the Safed Koh as Wardlaw-Ramsay found it very abundant in May in the Hariab Valley, especially about the summits of the mountains. On Matungi 12,600 ft., an offshoot of the main range, they were apparently breeding in the rocks of the summit. This is confirmed by Whitehead who says that the bird breeds in small numbers in the cliffs of the Safed Koh up to the highest elevations. Further north Meinertzhagen found them common at Jalalabad and evidently breeding on 31 May as they were seen to enter crevices in walls.

Yate obtained specimens in Badghis and Murghab in May but the status in Northern Afghanistan is not very clear so Meinertzhagen's remarks may be quoted in full:—'Swifts were first encountered near Kabul on 7 April when a few birds were passing from east to west. In the Ghorband Valley on 15 and 16 April a colony of about fifty birds was seen flying to and fro about a rock face, but not breeding, as they were not there in May. On 18 April large parties were seen passing west and feeding on the way. On the Shibar Pass, 9,600 ft., on 19 April, many were seen passing north-west at about 10 a.m. At Bamian between 20 and 24 April every afternoon scattered parties would appear from the east and pass up the valley feeding, in a westerly direction, often hanging about the rock-caves and dwellings and even entering them, but eventually passing on. A few were seen at Doab, 5,000 ft., passing north, and large flocks would sometimes appear on the Danaghori Plains between 4 and 8 May. At Haibak on 11 May a few were seen.'

In the south at Kandahar the Swift is very common. Swinhoe says that he observed the first birds, three together, on 6 February. Hutton's first date was 20 February. Swinhoe says they were common in April and Hutton says 'during the summer' but it is not clear whether the status is that of a passage migrant or breeding bird.

Micropus affinis (Gray).

Specimen collected.—♀ 14 May 1879 Kandahar (St. John).

The Common Indian Swift is only recorded from the neighbourhood of Kandahar where St. John says it is found in small colonies here and there, though it is nowhere common. A few pairs breed on the Baba-wali rocks on the Arghandab River near Kandahar.

Caprimulgus europaeus unwini Hume.

Specimens collected.—♂ 12 May 1885 Khusan (Aitchison); 2 ♂ 12 May Kila Wali, ♀ Afghan Turkestan (Yate); ♀ 14 June 1933 Logar 5,700 ft., ♂ 4 June 1934 Kabul 5,700 ft. (Maconachie).

The European Nightjar is presumably a summer visitor to Afghanistan. In addition to the above records Swinhoe attributed to this species two nightjars seen at Dubrai on 25 April and Gatai 26 April, and St. John says that it is common everywhere on the Kandahar side, in suitable localities.

Caprimulgus asiaticus Latham.

Specimens collected.—♂ 14 April 1885 Tirphul, ♀ 16 April 1885 Khusan (Aitchison).

No other records of the Common Indian Nightjar.

Caprimulgus mahrattensis Sykes.

Specimens collected.—♀ 1896 Lijjikarez 2,400 ft. (Maynard); 2 ♀ Helmund (Cumming).

St. John referred to Sykes's Nightjar a specimen shot on the Helmund River near Girishk in 1880 a few days before the battle of Maiwand but it was lost with his baggage after the defeat. The identification was probably correct as Maynard obtained a specimen at Lijjikarez and as Cumming found this species very numerous from April to September in Seistan where it is to be seen and heard everywhere on the wing at dusk. It breeds on the gravel-strewn 'dasht' and Cumming secured eggs in April, May and June, as he describes in some detail (*J.B.N.H.S.*, vol. xvi, p. 690).

Psittacula himalayana himalayana (Lesson).

Specimens collected.—♂ Otipore, ♂ ♀ Pashat (Griffith).

The above specimens and an entry in his Journals that Griffith saw the Slaty-headed Parrakeet at Bharowal on 17 April 1840 provide the only records of this species for Afghanistan.

It may breed on the Safed Koh as Whitehead found a small nesting colony in the Kurram Valley near Zeran 5,800 ft.

Asio otus otus (Linnaeus).

Specimens collected.—♀ 15 January 1840 Kunar (Griffith); ♀ 1 Feb. Bala-Morghab, ♀ 16 Feb. 1885 Maruchak (Aitchison); sex? 10 March Kara Baba, Maimanah (Yate).

In addition to the above records Hutton says that the Long-eared Owl is common in the ruins of Old Kandahar about 3 miles from the modern city. This is supported by St. John's statement that he shot a specimen there, but it is not in the British Museum.

Asio flammeus flammeus (Pontoppidan).

Specimens collected.—♂ 26 Dec. 1884 Bala-Morghab (Aitchison); ♂ 19 March, ♀ 27 Oct. 1933 Bagrami, ♀ 15 Oct. 1933 Logar (Maconachie).

The Short-eared Owl is doubtless a winter visitor and passage migrant to Afghanistan. In addition to the above specimens I find that Hutton states that this Owl, as well as the last, is common among the ruins of Old Kandahar, that St. John saw three in a garden at Kandahar and that Swinhoe shot one at Gatai in April 1881.

Otus brucei (Hume).

Specimen collected.—sex? 13 April 1874 Panjah, Wakhan (Biddulph).

There is no other record of the Striated Scops-Owl.

Otus scops scops (Linnaeus).

Specimens collected.—♂ 11 April 1879 Kandahar (St. John); ♀ 12 April 1881 Kandahar (Swinhoe).

According to St. John the Scops-Owl is very common in favourable localities, keeping in summer to the juniper forest of the mountains and dispersing over the country in winter, but it seems probable that the latter part of the statement is too sweeping and the bird may be mostly a passage migrant in the low country. Much of the country would certainly be unsuitable for it in winter.

Athene noctua bactriana Blyth.

Specimens collected.—♀ 27 Feb., ♂ ♀ 10 March, ♂ 21 Sept. 1879 Kandahar (St. John); ♀ ♂ 24-26 Dec. 1880, ♂ ♂ 10 Feb. 1881 Kandahar (Swinhoe); ♂ 25 Oct. 1884 Padda Sultan, ♀ 6 Dec. 1884 Koaja-palounda, ♂ 1 Feb. 1885 Bala Morghab (Aitchison); 2 sex? 25 Jan.-4 Feb. Chahar Shamba (Yate); ♀ 1896 Shorawak (Maynard); ♂ 21 Oct. 1904 Kuhak (Cumming); ♂ 17 Dec. 1933 Logar (Maconachie); ♂ 18 May Tash Kotal 3,000 ft., ♂ 19 May 1937 near Baghlan 1,700 ft. (Meinertzhagen).

According to Meinertzhagen the Little Owl is not at all common in Northern Afghanistan. Single birds, presumed to be of this species, were flushed near Kabul in early April. Both the specimens obtained belonged to breeding pairs and a third pair was nesting in the old fort at Kunduz.

In Seistan it is also uncommon as Cumming's Kuhak specimen, shot from a high bluff near Rud-i-Seistan, was the only one met with by that observer. In South-East Afghanistan the bird is much more numerous as Hutton calls it common in the rocks and ruins of Old Kandahar. In New Kandahar Swinhoe says that it commenced breeding about the middle of March and that there were ten nests with young in the walls of the fort in the early part of April. A resident species.

[**Athene brama** (Temminck).

In Horsfield and Moore's Catalogue of the East India Company's Museum (vol. i, p. 65), a specimen of *Carine brama* is listed from Afghanistan (Griffith). This is not now in the British Museum and it is possible that there was some mistake either as to the identity or the exact locality.]

[**Strix aluco biddulphi** Scully.

Wardlaw-Ramsay states that once or twice he flushed a Wood-Owl in the Hariab Valley about Byan Khel 7,000 ft. in May and June and that he heard its call nightly. This he took to be *S. nivicolum* but it was doubtless *S. a. biddulphi* which Whitehead found to be a fairly common winter visitor at Kohat, coming down no doubt from the forests of the Safed Koh.]

Bubo bubo turcomanus (Eversmann).

Specimens collected.—♀ 7 Feb. 1879 Kandahar (St. John).

Meinertzhagen saw an Eagle-Owl being mobbed by Lesser Kestrels on the Danaghori plains on 8 May 1937. He picked up two wing feathers near Kunduz which exactly matched those of *B. b. turcomanus*. Cumming received and preserved a badly injured but living young bird, not quite fledged, said to have come from Shaharistan which was brought to him at Kuhak on 6 May 1905. According to Hutton an Eagle-Owl is not uncommon amongst the rocks of Kandahar and he procured a young bird there. According to Murray Capt. F. B. Peile collected a specimen at Zandra and Mr. C. F. Hutchins others at Mundi Hissar and Abdul Rahman.

These records appear variously under the names of *bengalensis*, *ignavus* and *turcomanus* but it seems likely that all refer to the same form which is represented by St. John's specimen in the British Museum.

Pandion haliaëtus Linnaeus.

In his Journals Griffith records the fact that he saw the Osprey at Pushut on 25-26 November 1840.

Aegypius monachus (Linnaeus).

Meinertzhagen met with single examples of the Black Vulture near Kabul on 4 April, in the Shibar Pass on 25 April and between Doab and Doshi at the end of April. St. John says that it may be seen occasionally, generally in winter, all over the country from the Bolan to Kandahar. It no doubt breeds in Afghanistan, as it certainly does in Baluchistan (Ticehurst, *J.B.N.H.S.*, vol. xxxii, p. 66) and a fellow officer of Colonel St. John had a tame young bird which was supposed to have been taken in the Girinsk district.

Gyps fulvus (Hablizl).

Specimens collected.—2 sex? Afghanistan (Griffith); sex? 3 August 1933 Kabul (Maconachie).

Meinertzhagen says that in early April he saw a good many Griffon Vultures feeding on dead animals near the Kabul-Jelalabad road but they were very wild and specimens were unobtainable. Otherwise he found them scarce and many carcases were left untouched. A few were seen near Bamian up to 9,300 ft. in the snows. Near Doab another one or two were seen on 28 April.

In ordinary times vultures are said to be scarce in Southern Afghanistan according to Swinhoe, and when the British Army first entered the country in the Afghan War of 1878-79 the carcases of dead transport animals used to lie about for days with scarcely a vulture near. Later on, however, the birds gathered all along the line of communications and in March and April this species was at Kandahar in large numbers. St. John shot a specimen at Khilat-i-Ghilzai and C. F. Hutchins collected a female at Melkarez on 6 July 1881. Unfortunately the only three specimens, listed above, in the British Museum available for examination are immature birds and it is therefore not yet certain whether Afghan birds belong to the typical race found in Persia, or to *G. f. fulvescens* found in India. Some form of Griffon breeds on the other side of the Safed Koh on the Samana.

Pseudogyps bengalensis (Gmelin).

Hutton says that the White-backed Vulture was not uncommon around Kandahar during the summer months but departed as the winter approached. He saw it also at Girishk on the Helmund.

St. John has an interesting note that in the Afghan campaign of 1878-79 numbers of these vultures accompanied the army on the march, finding ample sustenance in the camels that died at every halting place and strewed the road from Sukkur to Kandahar. In the spring of 1879 they disappeared and he did not see them again, a fact which he attributes to the laying of the railway from Sukkur to Sibi and the transporting of troops by it for the first part of their journey from India. The Tirah campaign of 1897-98 similarly attracted them to the plains of Thall.

Neophron percnopterus percnopterus (Linnaeus).

Specimens collected.—♀ 9 June 1879 Kandahar (St. John); 2 ♀ 11-12 April 1881 Kandahar (Swinhoe); 2 ♂ 1 ♀ 30 June 1881 Mundi Hissar (Hutchins); ♀ 13 March 1896 Lijjikarez 2,400 ft. (Maynard).

Griffith saw the Neophron at Yonutt on 29 August 1839. Meinertzhagen says that it is not too common in Northern Afghanistan but probably breeds there as he saw it throughout his stay up till the end of May. It was observed in the Ghorband Valley in mid-April, at Doshi at the end of April, a pair at Danaghori in early May and a pair at Haibak on 11 May. Five were seen near Kabul in late May and at Jelalabad on 31 May.

Wardlaw-Ramsay says (Ibis 1879, p. 446) that the Neophron occurs in spring at Byan Khel 7,000 ft. but he later (Ibis 1880, p. 47) modifies this to refer to the Kurram Valley.

Cumming says that he occasionally saw it near Kuhak and elsewhere in Seistan.

At Kandahar Hutton considered this vulture a common summer visitor (seen first apparently on 1 March) but this does not quite agree with St. John's views. Both he and Swinhoe agree that the bird is common everywhere in the Kandahar Province but St. John says that a few remained near Kandahar in the summer but the majority of those that swarmed about the camp in late winter and early spring disappeared in April and did not reappear till July or August. At Khelat-i-Ghilzai in October there were none and by the end of the same month they had all left Kandahar, not returning till the end of February or the beginning of March. I am not able to understand this account.

Gypaëtus barbatus (Linnaeus).

Meinertzhagen says that he found the Lammergeier thinly distributed throughout Northern Afghanistan during April and May; it was usually seen singly but sometimes as many as seven were seen at one carcase. Griffith mentions it in his Journals at Pashat (16 Feb. 1840) and at Bharowal (7 March 1840).

Hutton says that it is common throughout the whole of Afghanistan though I presume that this statement can hardly apply to Seistan. He particularly mentions it at Kandahar and at Girinsk on the Upper Helmund. St. John says that it is found everywhere in the Kandahar Province, a pair or two even breeding in the isolated rocky hills which rise 1,500 ft. or so above the Kandahar plain.

It appears to be most common along the Safed Koh where Wardlaw-Ramsay records it as very abundant and the only vulture in the Hariab Valley about Byan Khel 7,000 ft. Whitehead says that it occurs up to the summit of the Safed Koh.

[**Falco peregrinus** Tunstall.

There is no satisfactory record of the Peregrine in Afghanistan though it no doubt occurs there on passage. Hutton said he had a young male from Kandahar and Wardlaw-Ramsay saw a falcon in the Hariab Valley at 7,000-8,000 ft. which appeared to belong to this species.

About the end of June 1836 Vigne (Personal Narration of a Visit to Afghanistan etc., p. 136) shot what he called a 'Churk Falcon' soon after leaving Ghazni. Of this bird's appearance he gives a rough description and adds some account of it in the Punjab. Blyth thought that this specimen must have been a young Peregrine but it cannot be properly identified.]

Falco peregrinoides babylonicus P. L. Sclater.

Specimens collected.—♀ 5 Feb., ♀ 14 July 1879 Kandahar (St. John).

The Red-capped Falcon is said by St. John to be the commonest falcon of the Kandahar Province. Further information is lacking but it is most probably a resident.

Falco jugger Gray.

Specimens collected.—[♀] Afghanistan (Griffith); 2 ♂ 1 June 1937 Jelalabad (Meinertzhagen).

Nothing is known about the Lugger Falcon in Afghanistan beyond Meinertzhagen's statement that a pair were seen at Doab 5,000 ft. at the end of April [but can there have been a mistake of identity here?] and the fact that he shot two males on telegraph wires near Jelalabad.

Falco cherrug cherrug Gray.

Specimens collected.—♂ 14 Dec. 1884 Bala-Morghab (Yate); ♀ 11 Sept. 1933 Sar-i-bulak 10,000 ft. (Maconachie).

There is no other information about the Saker Falcon but it is presumably a winter visitor.

Falco subbuteo subbuteo Linnaeus.

Specimens collected.—♂ 1 Aug. Kabul, ♀ 4 Sept. 1933 Unai Pass (Maconachie); ♀ 25 April Bamian 8,500 ft., 2 ♂ 1 May Doshi 2,750 ft., 1 ♂ 2 ♀ 13-16 May 1937 Haibak 3,000 ft. (Meinertzhagen).

The Hobby is a summer visitor to Northern Afghanistan, where Meinertzhagen found them not uncommon and preparing to breed in the tall plane trees of Haibak. Solitary birds were seen at Kunduz on 21 May and in the Ghorband Valley on 23 May.

It is also found on passage. Meinertzhagen first met with a solitary female at Bamian on 25 April. On 1 May at Doshi a party of some 15 birds, apparently all males, arrived in the evening, hawking insects fairly high up in the air. All had gone by the next morning.

Maconachie's birds would also seem to have been on passage but on the label of the August bird he notes that they were seen fairly commonly in pairs, so they may also breed south of Northern Afghanistan.

Hutton says that the Hobby is found around Kandahar but does not seem to be common.

Falco columbarius insignis (Clark).

Specimens collected.—♂ 29 January 1879 Kandahar (St. John); ♂ 13 Dec. 1880, ♂ 11 Feb. 1881 Kandahar (Swinhoe); sex? March 1904 Takht-i-Shah (Annandale); [♀] 10 March, sex? 23 Dec. 1933 Logar 5,700 ft. (Maconachie).

The Merlin is a winter visitor to Afghanistan. Both St. John and Swinhoe agree that it is then common about Kandahar.

Falco vespertinus Linnaeus.

The Red-legged Falcon is only recorded by Meinertzhagen who saw many migrating at Bamian in company with Lesser Kestrels on 24 April. They were flying due north about 10 a.m.

Falco tinnunculus tinnunculus Linnaeus.

Specimens collected.—♀ Afghanistan (Griffith); ♀ 4 March, ♂ 27 Nov. 1879 Kandahar (St. John); 2 ♂ 3 ♀ 2-30 March 1881 Kandahar (Swinhoe); ♀ 3 Nov. between Khushk-rud and Kin, ♀ 18 Nov. 1884, ♂ 16 April 1885 Khusan, ♂ 24 April 1885 Tirphul, sex? 21 Jan., sex? 4 Feb., sex? 7 Feb. Chahar Shamba (Yate & Aitchison); ♀ 12 March 1896 Lijjikarez 2,400 ft. (Maynard); ♀ 5 Jan. Kabul, ♀ 10 Sept. 1933 Pani Kajak, ♂ 3 Jan. 1934 Chahiltan (Maconachie); ♂ 22 April 1937 Bamian 8,500 ft. (Meinertzhagen).

The Kestrel seems to be fairly well distributed in Afghanistan as a breeding bird. Meinertzhagen says that it was certainly breeding at Kabul, Bamian and Haibak. Wardlaw-Ramsay says it was breeding in the Hariab Valley at 7,000-8,000 ft. in May. Swinhoe found a nest with young in the ramparts of Kandahar in the beginning of April.

It is apparently much more common in winter, at any rate at Kandahar (St. John).

Meinertzhagen noted passage near Kabul on 13 April when about 20 birds were seen passing in a northerly direction in the forenoon. At Danaghori several were seen on passage to the north between 5 and 6 p.m. on 5 May and again at Haibak a slight passage was noticed in the evening of 11 May.

Meinertzhagen considers his Bamian specimen (and the breeding birds of Afghan Turkestan generally in all probability) to be *F. t. stegmanni* but I am not personally satisfied with the validity of this race and consider that the majority of Afghan specimens are certainly not separable from the typical form.

Falco naumanni Fleisch.

Specimens collected.—sex? 21 March Maruchak, Badghis, sex? 9 April Karawal Khana, Badghis (Yate), 4 ♂ 6-7 May Danaghori 2,300 ft.; ♂ 16 May 1937 Haibak 3,000 ft. (Meinertzhagen).

Yate procured the above two specimens in Badghis and St. John believed that he had seen the Lesser Kestrel at Kandahar without being able to verify the fact. Otherwise it remained for Meinertzhagen to give us more interesting details of its passage through Afghanistan. His account may be quoted in full:—'We first met the Lesser Kestrel at Bamian at 10 a.m. on 24 April, when a large scattered flock of these birds, mixed with Red-legged Falcons (*F. vespertinus*) passed over, flying due north for about ten minutes at an elevation of 300 ft. They had come down low over the Bamian Valley, but on leaving it to cross the Hindu Kush I watched them going up and up until lost to sight over the dazzling snows. This record was perhaps the most interesting of all during our trip as it located the great African spring migration returning to their breeding quarters in Asia.

'We next met the Lesser Kestrel at Danaghori at 8 a. m. on 6 May, raining hard, when about five hundred birds suddenly arrived from the south and pitched in some leafless fruit trees opposite our camp. Several shot, all sodden with water, and with empty crops. They moved on about 10 a.m. after the sun had come out. There was a second slight passage that same evening, when about fifty birds arrived and remained the night after feeding on flying insects far into the gloaming. This party remained the whole of the next day, and many of its members took pleasure in mobbing an Eagle-Owl; much to my annoyance, for the poor old owl wished to be left in peace and sit still, when I might have approached it, but these wretched little Kestrels thought it a great joke to stoop at it and worry it till it moved on, and they kept it going the whole evening.

'At Haibak on 16 May another large passage occurred in the evening about sunset, with a thunderstorm threatening. There were three to five hundred birds flying in a loose flock from 100 to 150 ft. up, hawking insects and picking others from the ground. They arrived from the south-east. The stomach of a male shot contained masses of grasshoppers and a large centipede. This party roosted in trees near the town and all had gone the next morning.'

Aquila chrysaëtus (Linnaeus).

Specimen collected.—♀ imm. 2 Oct. 1933 Yakhdarra (Maconachie).

The above specimen provides the only authentic record of the Golden Eagle in Afghanistan, but St. John says he is inclined to think that it occurs about Kandahar.

Aquila heliaca heliaca Savigny.

Specimens collected.—♂ 12 January, ♀ 20 January 1881 Kandahar (Swinhoe). Swinhoe says that the Imperial Eagle is common all through the winter at Kandahar where two or three are generally to be seen on the ground in the neighbourhood of the racecourse.

[Aquila nipalensis Hodgson.

Hutton says that a single specimen of an eagle was captured at Girishk in December which he took to be a Steppe Eagle. His description 'Plumage dark brown, two cinereous bands in the wings; feathers lanceolate on head and neck' certainly reads like this species which one would expect to occur as a winter species.]

Aquila rapax Temm. & Laug.

Meinertzhagen says that he saw a single Tawny Eagle at Danaghori on 10 May.

Aquila clanga Pallas.

Specimen collected.—♀ 4 Feb. 1879 Kandahar (St. John).
Meinertzhagen procured, but apparently did not preserve, a Greater Spotted Eagle at Danaghori on 6 May.

Hieraëtus fasciatus fasciatus (Vieillot).

Specimen collected :—♂ 21 Dec. 1884 Balamorghab (Clarke).
This is the only record of Bonelli's Eagle for Afghanistan.

Hieraëtus pennatus (Gmelin).

Specimen collected.—sex? 4 August 1934 Ashraf 4,200 ft. (Maconachie).
This bird in the white plumage, provides the only record of the Booted Eagle for Afghanistan.

Circaëtus ferox (Gmelin).

Specimen collected :—♀ 24 August 1879 Kandahar (St. John).
Meinertzhagen says that he saw a single Short-toed Eagle flying off with a small snake in the Ghorband Valley at 8,200 ft. on 19 April. On 9 April a pair was seen at the western end of the Shibar Pass at almost 9,000 ft. At Bamian they were seen on three occasions in late April.
According to St. John this species was not uncommon in the Province of Kandahar. He frequently noticed its habit of hovering like a Kestrel.

[Haliaëtus leucoryphus (Pallas).

Cumming says that on 12 January 1905 he saw a pair of birds on the high bluffs bordering on the Hamun-i-Sabari between Farrah Rud and Kuh-i-Gach which very closely resembled this species, Pallas's Fishing-Eagle.]

Milvus lineatus (Gray).

Milvus migrans migrans (Boddaert).

Milvus migrans govinda Sykes.

Specimens collected.—sex? Afghanistan (Griffith); sex? 26 April 1874 Panjah, Wakhan (Biddulph); 1 ♂ 5 ♀ Jan., Feb., April, Sept., Nov., Dec. 1879 Kandahar (St. John); ♂ 14 Feb. 1881 Kandahar (Swinhoe); sex? 4 April Chahar Shamba, sex? 9 April Karewal Khana, Morghab (Yate); ♂ 10 May 1896 Robat 4,300 ft. (Maynard); ♀ 25 April 1906 Peiwar Kotal 8,000 ft. (Whitehead); ♂ 29 August Kabul 5,700 ft., ♂ 1 October 1933 Sangi nawishta (Maconachie); ♂ 29 April 1937 Bamian 8,500 ft. (Meinertzhagen).
I have not been able to disentangle the status of the three forms of Kite which are all said to occur in Afghanistan. Their identification is always a matter of difficulty. Different writers have identified many of the above specimens differently and many of them are immature while the matter is further

confused by the statements in the literature which do not seem to agree with the evidence of the specimens.

It must here suffice to say that some species of Kite, which has been variously identified with all three forms, is common at Kandahar, apparently as a summer visitor; that in smaller numbers Kites may be found at some season or other throughout the country; and that the dominant form is almost certainly *Milvus migrans migrans.* Like vultures, kites tend to follow an army in the field (as has been specifically noted in the case of the Afghan War of 1879-80 and in the Tirah Campaign) so it must be remembered that St. John may have been perfectly correct in saying that *M. m. govinda* accompanied the army in numbers to Kandahar but that it might not normally be found there.

Under these circumstances I have not considered it profitable to detail the records in full. It is however of interest to note that Meinertzhagen observed a 'considerable passage of Black Kites at Bamian from 21 to 24 April. These waves of passage always occurred at the same time towards evening, when birds could be seen coming in from the south, five or six hundred feet up. They would all make for a grove of tall poplars where they roosted for the night and next morning all would be gone. On some evenings ten to fifteen birds would arrive, but on the 23rd over fifty. On that day three birds were shot, all males'. These he identified as *Milvus migrans migrans.*

[**Elanus caeruleus vociferus** (Latham).

Specimen collected :—sex? Afghanistan (Griffith).

The Worcester list contains the entry of the Black-winged Kite as obtained at Kabul by Captain Hay. It is perhaps desirable to wait for confirmation before this species is fully admitted to the list.]

Circus macrourus (S. G. Gmelin).

Specimens collected :—sex? Otipore (Griffith); ♂ 3 April 1881 Kandahar (Swinhoe); ♂ 18 March Maruchak (Yate); ♀ 2 March 1896 Mehrab Nawar 3,000 ft. (Maynard); (♂) Feb. 1903 Band-i-Seistan, (♀) no date Shaharistan (Annandale); ♂ 28 Feb., ♀ 15 March, ♂ 22 March Baqrani 5,700 ft., ♀ 5 Sept. Farakhulm, ♀ 24 Sept. 1933 Logar 5,700 ft. (Maconachie); 2 ♀ 24 April Bamian, ♂ 8 May 1937 Danaghori (Meinertzhagen).

According to St. John the Pale Harrier is a very common spring and autumn passage migrant through Afghanistan and rare in winter. The records agree with this status.

Meinertzhagen says that at Kabul on 4 April many were seen slowly hunting their way north, all single birds. At Bamian on 24 April about 40 birds passed at 10 a.m. on a northward course, all being females. On 6 May at Danaghori there was a slight passage at sunset, a few straggling birds passing towards the north-east.

At Kandahar in 1881 Swinhoe found them passing through in the early part of April, the passage lasting for about 10 days.

Circus pygargus Linnaeus.

Specimens collected.—sex? Afghanistan (Griffith); ♂ 17 April Karawal Khana, Murghab (Yate); ♂ 25 March 1934, Logar 5,700 ft. (Maconachie).

These specimens and a male shot by Meinertzhagen at Barfak 3,400 ft. on 1 May 1937 provide the only records of Montagu's Harrier for Afghanistan. It is doubtless a passage migrant.

Circus cyaneus cyaneus (Linnaeus).

Specimens collected.—♀ 30 Jan. 1879 Kandahar (St. John); ♂ 23 December 1884, ♀ 11 Jan. 1885 Bala-Morghab. Badghis (Aitchison); ♀ 25 Nov. Zulfikar, Badghis, ♂ 1 Feb. Chahar Shamba, Maimanah, ♂ 10 March, ♀ 13 March Maruchak, Murghab (Yate).

These records suggest that the Hen Harrier is a winter visitor and Hutton has to say of it: 'This is rather a common species at Kandahar and frequents the marshy tracts below the city to the south, where during the winter snipe and waterfowl are abundant. I saw them also at Girishk.'

Circus aeruginosus aeruginosus (Linnaeus).

Specimens collected.—sex? Afghanistan (Griffith); ♂ 20 April 1874 Panjah, Wakhan (Biddulph); ♂ sex? 22 Feb.-4 March 1879 Kandahar (St. John); 4 ♂ 1 ♀ 14-23 Feb. 1881 Kandahar (Swinhoe); ♂ 12 March Maruchak, ♂ 16 April Karawal Khana, ♀ 13 May Kilawali, Murghab (Yate); sex? March 1903 Nadali, sex? March 1904 Takht-i-Shah (Annandale); ♀ 10 Dec. 1918 Lab-i-Baring (Annandale); ♀ 8 March 1933 Bagrami 5,700 ft. (Maconachie); ♂ 24 April Bamian, ♀ 3 May 1937 Doshi (Meinertzhagen).

Hutton says that the Marsh Harrier is common at Kandahar especially near a small swamp to the south of the city and along the banks of canals in the cultivated tracts. St. John adds that it is common in winter but Swinhoe says that it arrived there early in February and was there in some numbers up to the date of his departure, 22 April. This suggests that the majority are passage migrants though some birds are certainly found in winter in Seistan (vide the specimen of 10 December) where Annandale says it is the commonest bird of prey over the reed-beds of the Hamun. Biddulph thought that his Panjah specimen which was accompanied by a second bird might be breeding in the high reeds of the swamp where he found them, but all the other specimens agree in being evidently passage migrants and Meinertzhagen was lucky in meeting a most marked passage at Bamian. There on 24 April the passage commenced suddenly at 6 p.m., birds arriving from the south-east and south, all adult males. They were obviously fatigued for they came down to roost on a ploughed field. Some 66 birds were counted and more were still arriving at dark. They must have left early again as there was no sign of them in the valley soon after daybreak. On the following day and at the same time about ten adult males arrived from the same direction and roosted in that identical ploughed field and were gone again next morning.

Buteo rufinus rufinus (Cretzschmar).

Specimens collected.—sex? Afghanistan (Griffith); ♂ 24 Jan., ♂ ♀ 7 Feb. 1879 Kandahar (St. John); juv. July 1879 Byan Khel (Wardlaw-Ramsay); 2 ♂ 1 ♀ 1-23 Oct. 1879 Kelat-i-Ghilzai (St. John); ♂ 19 Dec. 1879, ♀ 14 Jan. 1880 Kandahar (St. John); ♀ 21 Dec. 1880, ♀ 12 Jan. 1881 Kandahar (Swinhoe); ♀ 9 Oct. between Sha-Ismail and Salian, ♂ 6 Dec. 1884 between Koaja-Palounda and Karez-darra, Badghis, ♂ ♀ 11 March 1885 Gulran, Badghis (Aitchison); ♂ 27 Jan., ♂ n.d., ♀ 4 Feb. Chahar Chamba, Maimanah, ♀ 10 March Kara Bel, Maimanah (Yate); [♂] Feb. 1904 Seistan (Cumming); ♀ 3 Sept. Logar 5,700 ft., ♀ 7 Sept. 1933 Badasiab, ♂ 3 Nov. 1934 Logar 5,800 ft. (Maconachie).

The above series includes both the very pale and the very black phases of the Long-legged Buzzard. This species breeds in the Hariab Valley 7,000-8,000 ft. near Byan Khel where Wardlaw-Ramsay received the above juvenile (of the black phase) from an Afghan. It probably came from a nest on a steep ledge above the camp which was known to Wardlaw-Ramsay and of which he had tried unsuccessfully to obtain the parent birds.

Nobody else has recorded any notes on this species except Meinertzhagen and St. John. The former saw an occasional bird around Kabul between 6 and 12 April and two birds at Danaghori on 6 May. The latter says that it is the commonest bird of prey in the country except in summer when it vanishes. No doubt it is in the main a winter visitor and passage migrant.

Buteo buteo vulpinus Gloger.

Specimen collected.—♀ 10 Sept. 1933 Katakhak (Maconachie).

This is perhaps the form which, under the name of *Buteo desertorum*, Cumming says he shot at Reg Mori on 27 Feb. 1904.

[**Astur gentilis** (Linnaeus).

Although there is no definite record of the Goshawk in Afghanistan it is safe to assume that it occurs on spring and autumn passage, but rarely, as Mr. Donald, one-time Political Officer at Kohat and a keen falconer, relates the method of catching them in the Independent territory north of Kohat (Ibis 1909, p. 262)].

Astur badius cenchroides Severtzov.

Specimens collected.—♂ Afghanistan (Griffith); ♂ 9 April 1881 Kandahar (St. John); ♀ 14 April 1881 Kandahar (Swinhoe); sex? 13 Feb. Chahar Shamba, Maimanah (Yate); 2 ♂ 1 ♀ 14-18 April Ghorband 8,200 ft., ♂ 12 May 1937 Haibak 3,000 ft. (Meinertzhagen).

In Northern Afghanistan Meinertzhagen first met with the Shikra on 14 April in the Ghorband Valley when there were a few roosting in willows with Sparrow-hawks. They became more abundant on 16 April, males predominating, and were still common on the 17th but all had gone by the 18th. These no doubt were on passage and the bird was not noted again until Haibak 3,000 ft. where a few pairs were nest-building. At Kunduz it was again breeding in a plane tree as at Haibak.

In Southern Afghanistan the Shikra is not uncommon, according to Hutton, but the status is not recorded.

Accipiter nisus nisosimilis (Tickell).

Specimens collected.—♀ 4 January, ♀ 5 Feb. 1880 Kandahar (St. John); ♀ 14 April 1881 Kandahar (Swinhoe); ♂ 6 Dec. Hanz-i-Khan, Badghis (Yate); ♂ Shili Kach (Maynard); ♂ 23 Feb. Chahiltan, sex? 2 July 1933 Ashraf, ♀ 24 Sept. 1934 Ashraf Valley 4,200 ft. (Maconachie); ♀ 12 April Paghman 8,000 ft., 3 ♂ 2 ♀ 14-18 April 1937 Ghorband 8,200 ft. (Meinertzhagen).

Some form of Sparrow-hawk breeds in the mountains along the eastern border of Afghanistan as Colonel Rattray (*J.B.N.H.S.*, vol. xii, p. 344) mentions a young bird in down being brought to Parachinar in July from the Safed Koh. Mr. Donald also states that it breeds freely in Tirah (Ibis 1909, p. 262). Wardlaw-Ramsay on the other hand only once observed a Sparrow-hawk in the Hariab Valley. The identity of this breeding race has not yet been established but it is doubtless the Himalayan race *A. n. melanoschistos* which breeds at Ziarat in Baluchistan.

Be that as it may the Central Asiatic form is evidently a common winter visitor and double passage migrant to Afghanistan generally.

In the south Hutton calls it common at Kandahar; St. John says it is common all over the Province in spring and autumn; Swinhoe found it common in the spring.

In the north Meinertzhagen first noted it in the Ghorband Valley at about 8,200 ft., when several, mostly males, were roosting at dusk in young willows on 14 and 15 April. On the 16th there was a large influx, again mostly males, consorting with Shikras. On the 18th they had almost gone. At Bamian there was a heavy influx on 24 April, as many as 20 being seen in one small poplar grove. These of course were all on passage.

(*To be continued*)

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. ST. J. MACDONALD.

PART VIII

(*Continued from page* 188 *of volume* 45).

SEA AND ESTUARY FISHING (*continued*).

Bahmin in Malabar by Munisheh (5). Sea-fishing (West Coast) by Lt.-Col. R. W. Burton (6). East Coast angling localities by Sri E. K. Mahdavan (7).

5. BAHMIN IN MALABAR by MUNISHEH

To the scientist he is known as *Polynemus tetradactylus*, in more common parlance 'Bahmin' (Malayalam); to the unfortunate who tries to catch him, 'a devil incarnate'.

He lives, amongst other places, on the West Coast of India in close vicinity to tidal creeks; is said to attain to a length of 4 ft.; and is very rarely above 20 lbs. in weight. But the normal size caught on a rod and line varies between 3 and 7 lbs.

Having previously heard of and read of his prowess, on being ordered to the Malabar Coast, I was determined to try my hand at catching this most elusive fish. The combined experiences of myself and some friends may prove to be of interest.

Having studied minutely all that those recognised authorities on fishing in India—'Skene Dhu' and H. S. Thomas—could tell us on the subject, we now, with the greatest of deference, beg to differ on several points. The authorities instruct one to be satisfied with spinning one's lure round the piers of rail and road bridges. These span the rivers and creeks every few miles up and down the long coastal strip. Apart from the fact that the fish seem to haunt these spots only when conditions in other places are not suitable, the added difficulty of dealing with such a wild creature rushing madly in and out of any obstruction that may give him the least opportunity to break, causes one to avoid such localities as far as possible. Also, it is not everybody who has the head to walk placidly up and down the open sleepers of a railway bridge. Most of the rivers on this coast have very narrow mouths, in and out of which the tide runs at great speed, and there are definite bars about 400 yards out from the actual line. Experience has proved that there is more probability of finding the fish in either of those spots, rather than inland near the bridges.

The chief difficulty is to ascertain the time that the fish are likely to be present at one's selected locality. There appears to be no reason for their movements. One day they will be there in their hundreds. The next day with identically the same conditions as regards temperature, water, tide, light and wind, there is not a fish in sight. The most probable times are, however, early morning and late afternoon.

The second main point of difference is the question of lure to be used. The authorities recommend an almost exclusively dead bait. This has been tried, and in addition, phantoms and spoons. The best sport was obtained by using a large and heavy spoon—three inch size being the very smallest. Even a small bahmin of $1\frac{1}{2}$ lbs will take this without any hesitation. A heavy spinning rod with a reel capable of carrying 150 yards of stout line is a *sine-qua-non.*

The method adopted is to be at the selected locality at the same time as fish have been reported to be rising on the previous day. A rough country boat is procured, with two paddlers, and one possesses one's soul in patience in the hope that a rise will occur. If one's luck is in, there is no chance of missing that rise. The water boils and foams with maddened fish. The boat is propelled as fast as possible to the spot before the shoal moves on or disappears. Casts need to be long, and the line reeled in as fast as humanly possible. The spoon is liable to be taken at any time, from the moment it touches the water until lifted out preparatory to the next cast. On more than one occasion a fish has rapped its head against the boat in its last frantic effort to seize the lure. There is neither time nor necessity to strike; all that is required is a constant tight line. Needle-sharp hooks are an essential; the bahmin has a bony mouth, and blunt hooks mean almost certain failure. Even when safely hooked, the odds are still in his favour. He is up to every known trick of the trade, including dancing on the surface with his mouth wide open and wildly shaking his head. One fish landed and three spoons lost constitute a red-letter day.

Apart from his fighting powers, the bahmin's great curiosity is his eyes. To quote H. S. Thomas in 'The Rod in India':—'The eye is covered with a fixed transparent membrane through which the eye may be clearly seen moving free of it inside it, and which is so tough that Colonel Osborn has twice hooked fish foul by it and landed them.'

At Mahé the local people catch them on heavy bazaar-made brass spoons, attached by a complicated series of swivels and thick brass wire to a heavy hand line. They haul this in hand over hand at a far greater speed than can be attained by an ordinary reel. In less sophisticated places the lure used is a piece of iron, about the thickness of a middle finger, and 6 inches long. Attached to the lower end of this and lying in one place are two large hooks. Half way up the metal rod is attached one more hook. The whole thing, except the hooks, is then bound with a piece of white cloth and attached to a strong hand line. Every morning and afternoon men may be seen sitting on the high banks of sand waiting for the fish to show themselves. As soon as the rise occurs, the men run down the bank into the breakers whirling the lures round their heads and casting them a perfectly amazing distance. As soon as the lure touches the water, they run back up the bank hauling the line in hand over hand at the same time.

All anglers who come to the Malabar coast have heard of the bahmin; they all prepare their tackle, full of zeal. Many give up the unequal contest. Even the few that persevere have little to show as a reward for their patience, and leave the coast feeling they have more than met their match. Some cease to regard it as a sport and term it a blood feud.

We hear that there are places outside Malabar where there are bahmin in great numbers at certain seasons, and that they can really be caught. We hope to visit them if opportunity arises, and have our revenge.

6. SEA FISHING (*West Coast*) by LIEUT.-COL. R. W. BURTON.

The West Coast of India, especially from Ratnagiri southwards, affords excellent sea angling at certain seasons and places.

Gadsden has dealt with Karachi, Bombay, and other localities; and G. D. Traylen with Bombay especially. No intending sea angler should fail to consult all the articles cited on the first page of this Chapter. Dr M. Suter has now dealt with fishing around Karwar.

All down the West Coast—the 'Canoe Coast' (the East Coast) is known as the 'Catamaran Coast,' the best of sport is to be had around the many islands scattered along the coast line, and at the channels where the many rivers enter the sea, also at certain places up the tidal backwaters, by means of the sailing dugouts everywhere available. Below Tellicherry and Mahé, however, there are long stretches of coast where there is little prospect of sporting fish being found, except at certain states of the tide at the mouths of the several estuaries; and the only places worth a visit are Beypore, Cochin, Quilon, at all of which accommodation exists, and Muttam. Opposite Muttam is Crocodile Rock where is 23 fathoms of water and many big fish of several species. Here is no sailing dug-out, the local craft being catamarans. Boat would have to be arranged for from further up the coast. The flat rocks are named by the boatmen of Muttam as '*Tharai-par*'; and the steep rocks '*Usantha-par*'; and the boatmen give names of Tiger shark (*Rajah, Thiruvalli-kalan, Pullyan soya*), Saw Fish (*Vela, Iluppa, Vaalu srava*), Tunny (*Choorai, Soorai, Kethal*), Bonito (*Ela-choorai, Mass*), Seir (*Nedunthalai, Varian*), Elacate nigra (*Kada viral*), Sword fish (*Thalapattu*), Spear fish (*Kopparah, Ola-meen*). Evidently Muttam is a place to visit, *with a proper sailing boat*. Season: October to February. No accommodation. Mention should also be made of Sacrifice Rock, 20 miles south-west of Mahé and 7 miles north-west of Cotta Point, where the depth is around 13 fathoms and many seir, caranx, and gar-pike can be caught.

Local enquiry has to be made as to time when the surface feeding fish are passing down the coast within the period mid-September onwards to mid-January; and this applies to whatever part of the coast is visited. At Quilon in the last week of December no seir were found, as the latter part of November and early December is apparently the time for them there.

Around the islands and rocky places one hopes for seir, caranx, mooloo (*Elacate nigra*), rock perch of several varieties, and gar-pike: bahmin, nair, mullet, gar-pike, and some other varieties are to be had at the channel entrances and up the tidal portions of the rivers entering the sea. But it is only the angler who has the leisure and opportunity to camp at such places (estuary outlets to the sea) who can be fairly sure of sport, for most of the river mouths are difficult of access and fishing can only be had at certain states of the tide, the time for which naturally varies from day to day. So camp one must, or undergo many blank days and disappointments.

The season for the angler, whichever portion of the West Coast he may select or have available to him, is from the close of the South-West monsoon about mid-September, to the middle of January. There may be fishing after that time but the writer is not able to say so.

Within the period mentioned the best time to fish varies all down the coast. Sometimes the monsoon closes by the end of August and then some of the surface feeding fish are migrating earlier: and off Karwar the bahmin may be more numerous and larger in size. As a rule it is not worth planning to fish before mid-September; and during October, sometimes early November also, violent storms may put a complete stop to all fishing for as much as ten days at a time, so those without leisure, or patience to wait, have to go home.

There is yet much to be learnt about the movements of commercially important and sporting migratory fish such as the seir and larger mackerels. This would involve a complete acquaintance with the smaller fishes and other food on which they feed, as their movements must be largely influenced by search for food. It is by reason of the presence of myriad shoals of 'sardines' of the herring family, and of the common mackerel (*Scomber microlepidotus*) which appear on the Malabar coast after the South-West monsoon, sometimes also large shoals of mullan (*Equula splendens*), that the large surface feeders are present; but there must be more to it than that or these fish would remain all the time with the shoals and not move down the coast as they do. Probably the reproductive urge is at work and the sumptuous feeding on sardines furthers that impulse. Where they go to spawn is not known; it is likely to be over banks far out to sea, of which there are several—, or it may be in the Gulf of Manaar.

Fishermen come in their fine boats from Ratnagiri to Malpe and from there go out of sight of land, this in the month of November, and bring in large catches of seir, kora, and other big surface feeders, also shark, so this is the time for the angler to visit Malpe, and the coast line for some distance above and below, as the writer has found. If the sea current is setting to the north there are no fish; the seir etc. come along with the shoals when the current comes from the North. Big storms often upset the season for a fortnight at a time, these upset the ocean currents. Mid-November is good because after the first week of that month storms are unusual.

An essential to successful sea angling is—as said elsewhere by the writer—to get a firm grasp of the habits and nature of the particular fish in quest; determine the method which will present the lure in the most natural way; ascertain what pattern of lure, or natural bait is most deadly; select the most suitable locality; and ascertain (the first essential) the precise part of the month or time of year during which the various species are to be found at the selected place.

There should be careful study of the weather and condition of the water, for sea fish, almost as much as freshwater fish, are affected by the temperature and condition of the sea and strength and direction of currents.

Causes of failure of newcomers may be mostly attributed to wrong gear, bait, locality, and judgment of water and weather conditions. Advice of local fishermen, although they may know nothing of rod angling, is most valuable as to exact locality, time, bait, and depth at which to fish: this last being very important. Local people give ready help as they are interested in one's success, for the sportsman usually gives the bulk of the catch to those who assist him to obtain it.

Only by reading and studying all the articles cited in this Chapter will the sea angler arrive at that success which he would otherwise attain at long last through vexatious and expensive experience. For instance, Gadsden had much success at various seasons but had evolved a killing method of baiting and presenting the prawn.

Except perhaps at Cochin and Quilon, where a friend might be able to arrange for a power launch, the angler has to depend on the sailing dug-out and the breezes that blow. Fortunately the wind is off-shore from early morning to mid-day and at that hour very punctually changes round to waft one back to land.

At a number of places the sailing dug-out is a fairly suitable arrangement, but all the same a good deal of valuable fishing time is wasted. The ideal for a keen angler with the necessary leisure—and not shy of a roughish time as to bodily comforts—is to hire a country sailing boat of about 15-17 tons, with a crew of six men and a sailing dug-out in tow, and live on it, so being free to go anywhere along the coast, anchor at a suitable place, and go off in the dinghy, or out to sea. Laccadive islanders have great fishing over the Padua Bank 150 miles west of Mangalore. This during December-January when storms very rarely occur.

There are many species of fish in Western India seaboard waters. Vernacular names change along the coast as the language of the people changes. Bombay to Ratnagiri Mahratti is spoken; then comes Goanese; Canarese; Tulu; Malayalam; Tamil; and along the East Coast north of Madras, Telugu; but even so the names of the fish will sometimes vary within these linguistic limits. Therefore one should have a scientific list to refer to and then, recognizing the Family to which any species belongs, a vernacular tag can be applied to the fish. Much of interest is lost if one does not know the names of fish taken: and the information is useful to others.

Mahratti names of a number of fish can be known from the Series 'The Fish Supply of the West Coast of India' elsewhere cited; and a scientific list with Travancore coast names is to be found in the *Journal of the Bombay Natural History Society,* vol. xxxiii page 347 et seq.

The writer can give names of some fish as known on the coast of South Canara and Malabar.

True mackerel	*Cybium guttatum*	Canarese, ***khullkul***; Tulu, *anjal*; Malayalam, *varimeen.*
Do.	*Cybium commersonii*	Canarese, ***arkulai***; Malayalam, *ayakoora.*
Do.	*Elacate nigra*	Mangalore coast, *mooloomeen.*
Horse mackerel	*Caranx*, of which a number of species.	Canarese, *parai.* Mangalore coast, *para, kanayan para.*
Do.	*Chorinemus lysan*	Mangalore coast, *pala, pala meen.*
Bahmin	*Polynemus tetradactylus.*	Canarese, *vameenu.* Malayalam, *Bamin.*
Thread fish	*Sciaena*, sp. two or three varieties.	Do *kora.*
Shark (dog-fish)	*Chiloscyllium griseum,* A shallow water shark.	Malayalam, *oodumbi shirav.*
Shark (ground shark of rivers).	*Carcharias gangeticus*	Malayalam, *sravu.* Canarese, *tamasi.*
Shark (hammer head).	*Zygaena blochii*	Malayalam, *kannankodi.* Canarese, *kabbethatte.*
Shark (tiger shark)	*Galeocerdo rayneri*	Tulu, *pilthatte.* Malayalam, *pullian sravu.*
Skate	*Rhynchobatus djeddensis.*	Do. *makara sravu.* Canarese, *etti-balliar.*
Cat-fish (Marine species).	*Arius, sp.*	Malayalam, *yata, etta.* Canarese, *thede.*
Sting ray	*Trygon sephen*	Malayalam, *nei-therandi.* Canarese, *neitherake.*
White pomfret	*Stomateus sinensis*	Do. *manji.*
	Do. cinereus	Malayalam, *vella avoli.*
Black pomfret	*Do. niger*	Canarese, *chandratata.* Malayalam, *karapu avoli.* Do *karutha akoli.*
Herrings and sardines.	*Clupea longiceps* Oil sardine, migratory	Do. *nalla mathi.* Canarese, *baige.*
Do.	*Clupea fimbriata* Oil sardine, migratory	Malayalam, *chella mathi.* Canarese, *pedi.*
Do.	*Clupea lile* The Malabar sardine migratory.	Malayalam, *veloori.*
Do.	*Dussumieria acuta* The Malabar sardine, migratory.	Do. *kolachi, kolakayan*
Silver bellies	*Equula splendens* The Malabar sardine, migratory.	Do. *mullan.*

Silver bellies ...	Family Gerridae ... Sometimes found in large shoals hunted by *seir*, *kora*, *Chorinemus lysan* etc.; length up to six inches.	Canarese, *kurichi.*
Gar-pike ...	*Belone, sp.* ...	Mangalore Coast, *kandai.*
A caranx ...	......	Do. *kadai.*
A spotted perch ...	......	Do. *ambai.*
Another perch ...	......	Do. *anjel muri.*

The common mackerel forms the main fish harvest on portions of the Malabar coast, and is the fish one mainly uses for dead and live bait when fishing away from the shore. It is *Scomber microlepidotus*, about 3 to 5 to a pound, Mangalore coast *bangada, bagala*, also *ila*.

The Great Indian Fin Whale is very rarely seen. So it was a great surprise when one of these huge creatures uprose about fifty yards from my anchored boat near Sacrifice Rock.

Of all the fish listed above *C. guttatum* is perhaps the most prized by the angler, as it runs to six feet and 60 lbs. and speeds like a race horse. *E. nigra* is a most dogged fighter. Those caught by the writer have not exceeded 40 lbs.; but the fishermen say they grow 'as big as three men' and are sometimes so taken in their nets. I have no confirmation of this, and doubt it. Day does not mention size limit.

All horse mackerel (*Caranx*) fight well; fighting qualities of bahmin are well known, the ordinary size is five to ten pounds or so, and around Karwar up to 25 lbs. may be taken. There is record of 34 lbs. at Goa (*'The Field'*, April 1930). Gar-pike are 2 to 5 lbs.: 10 lbs. is a big one. Mullet may be up to 2 lbs. or so. As to fishing for the above (mullet and gar-pike) Gadsden should be read as to baits and tackle so also for bahmin. Gadsden and Traylen deal especially with sea angling around Bombay.

Part of the definition of what constitutes sport may be said to be the making of it as great a test as possible consistent with reasonable fulfilment of the main object in view. From this standpoint, with tackle to suit the weight of the species as ordinarily caught, the bahmin is in a class apart from other sea fish off the coast as he is indeed a contrary and elusive creature. So perhaps something about the bahmin may be of interest and use to intending anglers.

Gadsden describes him as a magnificent, game-looking fish and something of a cross between a salmon and an English sea-bass. More handsome than the salmon though not so aristocratic looking.

Apart from appearance the bahmin can be likened in a number of respects to the English sea-bass. He is a sea fish, as is the bass, and is equally fond of running up estuaries; he can be successfully fished for from the shore in the roughest weather; he has a varied diet, but is especially fond of prawns and small fish; he prefers a spoon bait silvered on both sides, with a sliver of mackerel tailing on the end hook; he takes a fly; and is much esteemed as a fish for the table.

In all the above respects the two species are alike. They are also alike in that both of them are the most difficult and contrary fish with which it is possible to try conclusions. Like bass, bahmin are found in-shore and around rocks. They are fickle and difficult. One day they may be caught and the next, under apparently precisely similar conditions, they will wholly elude one. When in pursuit of bahmin one should bear in mind all that is written by expert anglers for bass. In one respect they are different: the sea-bass takes a prawn by the tail, the bahmin by the head. If a live prawn be used it should be hooked through the last but one segment from the tail and the trace continued for another hook to be placed below the head and tied there (also the in-between piece of trace) with coloured thread. Other fish besides bahmin may take the bait, and mounted in this way it is ready for all comers. If the prawn be hooked through the head it does not live long; in quiet water a lively prawn is the better bait.

If a dead prawn is used it is best mounted in Gadsden's way. Whatever the bait may be the size of hook must be suited to the bait, and the bait fished at proper depth, being kept there by lead of suitable weight. Two or three feet below the surface may be usually correct but circumstances must decide. If speed of the tide does not keep the bait up a float of the sliding or 'release' type is essential. Both the 'Summers' and the 'Wallis' are good.

Reverting to the two species. They are alike in that the ordinary size taken is from five to twelve pounds; and differ in the rod and line maximum recorded weights, as the record for the English sea-bass around the coasts of England and Ireland is close to 17 lbs. and the bahmin has been caught up to 34 lbs.

It is well, in this place, to say something regarding the genus *Polynemus* of which there are as many as eight species (Day's Fishes). Of these, two only attract the attention of the sea angler, the others being small fishes.

In the *Rod in India*, second edition, page 210, the usual descriptive quotation (from Day's Fishes of India, Burma and Ceylon) of both *P. tetradactylus* and *P. indicus* will be found. No mention of *P. plebeius* is made in the book.

In vol. 34, No. 4, pages 979-980 of the *Journal of the Bombay Natural History Society* will be found much of interest regarding the two larger species of bahmin. It seems the Mahratti name '*Ravas*' is applied generally to all the *Polynemus* species. It may well be the case that sea anglers catch not only *P. tetradactylus* but *P. indicus* also.

In an article on 'Estuary Fishing as an Industry in Western India' W. A. Wallinger gives at page 635 of vol. 17, No. 3 of the Society's *Journal* a list of fish taken in, and at the mouth of, the Kolaba greek classified according to their size and habits. Under 'Large Migratory Fish' weight of *P. tetradactylus* is given as 'locally said to attain 168 lbs.' while in the margin is remarked 'Buchanan gives 320 lbs'.

The origin of this 320 lbs. statement passed on from one writer to another evidently emanates from Dr. Day's 'Fishes of India etc.' where he gives the size of this species as 'attaining six feet and upwards in length' and adds Hamilton-Buchanan observes: I have been assured by a credible native that he saw one which was a load for six men, and which certainly, therefore, exceeded in weight 320 lbs. avoirdupois.

In that same list (Wallinger's) *P. plebeius* is 'locally said to attain 50 lbs.' while no mention is made of *P. indicus*. Day gives length of *P. indicus* as four feet, and weight as 'rarely above 20 lbs'. At page 979 of vol. 34 we find from records of the Steam Trawler 'William Carrick' that the average weight of *P. indicus* taken in the nets was 13 lbs., and the heaviest individual fish of this species recorded was 34 lbs.—total length 3 ft. 8 inches. No specimen of *tetradactylus* larger than 15¼ lbs. was taken by the trawler.

Wallinger calls *P. plebeius* 'Dara', which is the Bombay locality name for *indicus*. It is certain that his 50 lbs. refers to *indicus*, and his 168 lbs. for the other. 'Rawas' is probably a mistake of the informing fishermen. Anyhow we are still without sufficient proof of the size to which *Polynemus* attains beyond the specimen of *P. tetradactylus* 38 lbs. captured with a cast-net in very shallow water south of Pamban as witnessed by Sri E. K. Mahdavan, Assistant Director of Fisheries, who says that *P. indicus* is also found in that locality.

It remains to say how these two species can be readily distinguished, and leave to future sea-anglers the pleasure of contributing records of weights to the Honorary Secretary of the Bombay Natural History Society.

Polynemus tetradactylus—

Four free pectoral rays reaching to the end of the ventral. Air-vessel absent. *Colour.* Silvery-green, becoming yellowish-white on the sides and abdomen, dorsal and caudal grayish with minute black points and nearly black at the edges: ventral and anal pale orange in their outer halves, pectoral filaments white.

This species is a more shapely fish than the next and has the silvery sheen and graceful body contour which call to mind comparison with the true salmon of the north. (Vol. 34, p. 980.)

Polynemus indicus—

Five free pectoral rays reaching nearly to the anal fin. Air-vessel long and narrow. Vertical fins dark edged. Lateral line continued along the lower caudal lobe almost to its end.

Colour, black purplish black, abdomen silvery white, dashed with gold. First and second dorsals, also anal, stained with black as is likewise the lower half of the opercle. Caudal with many black points.

Tackle for Sea Angling.

Until fairly recent years sea rods, lines, traces, etc. have been unnecessarily coarse and heavy. This still obtains to some extent. It is seldom one catches with rod and line off the coasts of India fish heavier than sixty pounds. Take the seir fish, 200-250 yards 9 cord cuttyhunk is sufficient; so also for bahmin. There is no real reason why sea tackle should be coarser and heavier than freshwater tackle. If it is wished to struggle with big sea perch of species which grow to hundreds of pounds in weight it is better to anchor and use a heavy hand line. If such fish are hooked when trolling for surface feeders the best thing is to break away, if necessary, and in anticipation of that contingency the trace should be of lesser breaking strain than the line. That indeed is a usual practice in most classes of angling.

Rods.

The best sport is obtained by use of a spinning rod of greenheart (preferably spliced) or ringal cane (not split cane—the sun, sea water, and humid climate will soon ruin it), length about 8 feet for boat work. All metal work brass or rustless, rings protected porcelain, or agate, end ring side-protected also. This rod for surface trolling around rocks and islands, and drift-line fishing. The cork handle in front of reel should be wrapped over with whipcord to give nonslip hold.

For fishing from the shore and at estuary channels a longer spinning rod is better. The writer uses 10 ft. 6 in.

For mullet and estuary gar-pike, a trout rod and light tackle.

The majority of modern anglers, both sea and freshwater, prefer the short bait-casting rod, or a modification of it, and multiplying reel. The use of such an outfit has many advantages. Though the rod is not very suitable for trolling it is valuable for its easy overhead and far-casting capacity, especially when a school of bahmin is feeding on the surface, or one is fortunate enough to be close to a shoal of small fish being raided by seir etc.; and for gar-pike around island rocks; also others in the boat are not endangered by flying hooks. Stiff sea rods spoil sport unless the fish are very large, and those should be separately catered for. The spinning rods will cope with all one meets, and the springy action maintains hook-hold in bony mouths.

Care has to be taken to tire out a fish before bringing it to the gaff or it may go under the boat and smash the rod. Boatmen should be carefully instructed in use of the gaff. Carry a spare rod.

Reels.

The reel must be proof against sea water corrosion, of strong make, free running, have line guard, check, and adequate braking arrangement, and balance the rod in use. Nottingham brass backed reels of 5 inches diameter, also Bakelite and other makes of similar size, will give good service. Ratchet check reels sing pleasant songs but the teeth wear out. Spares should be carried. With all reels of this type one has to beware of rapped knuckles from revolving handles.

American and other multiplying reels of sufficient line capacity (200 to 250 yds.) meet requirements; but as all such reels have to be fixed on top of the rod rings need to be duplicated, and care taken that they are sufficiently close together to prevent wear of sagging line.

Reels of the silent and stationary handle type such as the 'Fortuna' and other makes, with the star brake controlling the drum, are longer lasting and give effective control of the fish at all stages of the fight. A 5-inch reel of this type will take ample line and fulfil all trolling and drift line fishing requirements for as heavy fish as the angler will need to deal with in Indian coastal waters.

It is likely that after the present War reels of more unbreakable plastic material than Bakelite will be on the market. The great advantage of plastic material reels is that their comparative lightness enables the rod to be suitably balanced with a reel of large line capacity. Carry a spare reel.

Lines.

It pays to use the best quality line. Cuttyhunk—12 thread (30 lb. b.s.) suffices for trolling. For spinning, and the casting rod, braided line is necessary. For float fishing the front 30 yds. should be of silk, and greased.

The whole line should be tightly wound on to obviate 'bird's nests' and disaster. The line should be double-looped to the swivel and whipped, without knotting, a few inches above.

Lines should be washed in fresh water after use; and for this purpose it is convenient that the line winder be of make and material to permit of immersion in the bath.

Line for trolling should be marked by red wool tags twisted in at 30 yds.—the usual trolling distance, 40 yds. for keeping the bait at greater depth, and 100 yds. It is well to have two tags a few inches apart at 40, and three tags at 100 so that, after dark, it can be known by feel what line is out.

The Sunn Hemp (*Crotalaria juncea*) is grown all along the coast. The fisher folk make their nets and lines from the retted fibre. In case of necessity one's trolling line losses can be quickly made good by use of a line twisted to order of length and thickness required, and waterproofed by rubbing with green fruit of a tree growing in many swampy places. It is *Diospyros embryopteris*, Malayalam, *Panichi*; Tamil, *Panichchai*.

The floats used by the fishermen for their nets are from the dried wood of the evergreen tree (*Cerbera odollam*) which grows along the coast, Malayalam, *Othalam;* Tulu, *Thendamara;* Tamil, *Kadama.*

In 1943 a 300 yds. 24 lbs. line made on the coast to order in 1935 at cost of Rs. 3 was loaned to a friend who killed with it, paste fishing, a 76 lb. mahseer.

Trace.

This should be of rustless wire. Killin wire can be used, but may entail loss of fish unless great care is taken for it very quickly rusts in sea water. Trace used in the morning may not be safe for the afternoon.

A wire which is quite rustless under any conditions is the Wissco Leader-Wire of polished stainless steel sold by the Wickwire Spencer Steel Company of New York and San Francisco. It is sold by weight and is not expensive. Takes solder well and does not corkscrew or kink. There are other rustless trace wires not yet tried by the writer. The 'Asal Special C.N.' and the 'Elasticum'. The former does not corkscrew or kink, and the latter stretches considerably without losing strength. On general principles the trace wire should have a less breaking strength than the reel line: also the finer one fishes the better. Generally the trace should be a foot or so longer than the largest fish one expects to catch.

Brass wire, annealed, makes a good trace. It is not sufficiently pliable for spoon fishing but does well for trolling. Indian coast fishermen use it for drift-line fishing and catch big fish. One writer on bahmin fishing used brass picture wire for traces and found it better than anything else, but that was many years ago. The wire must be *brass* and not iron, 'brass-washed',—as is now mostly sold.

Swivels should be brass, or white metal (dulled, or fish may snap at them). Sizes to suit the tackle in use.

Brass wire connecting links are necessary for change of lure, whether spoon or dead bait, and can be made up by the angler.

All gear must be sound; any weak point will soon be made apparent by the fierce and furious rushes of sea fish which are considerably stronger, weight for weight, than freshwater fish.

Spoons.

Heavy spoons made from 1/16 inches copper sheeting and coated all over with silver solder, 3 in. long by 1⅞ broad with 'dish' of ⅜ inch are suitable for bahmin. These spoons should not spin very fast, to ensure which both hooks should be attached to the spoon itself and not fly loose, and be wobbly in action. With the bait casting rod smaller spoons have to be used. Spoons for bahmin, as also for all sea fish, are improved by a thin sliver of silvery mackerel attached to the end hook.

For seir and other pelagic fish a spoon with a wavy action, such as the 'Knowles Automatic Striker' (4½ inches), and the Gibbs Stewart, brass and nickel, size 6 (4½ in.) are good; so is the Japanese white feather bait; and probably the Pflueger Chum Spoon which has not yet been used by the writer: there are other designs also.

Best of all, for the big surface feeders, is a dead bait mounted to work in the water with a wavy action: dead baits for sea fish should not spin. A lure which is good over coral reefs and rocky places is a bright spoon, without hook, with a sliver of fish on a wire-mounted 5/0 hook trailing six inches behind the spoon. The mount must be attached to the trace and not spin with the spoon which merely acts as an 'advertiser' to the bait behind it.

An effective oval 'fly spoon' bait can be made from the triangular tail piece of a fresh mackerel. Sharp knife and scissors necessary. A single No. 1 eyed hook is passed through the silvery side and back again leaving the shank of the hook on the fleshy side. The piece of tough tail skin is tied to the trace above the hook eye in such a way as to give a somewhat convex shape to the silvery side of the bait. This is a good lure for gar-pike and other fish, especially in choppy water.

Hooks.

Single hooks should be Limerick bend, have turned down eyes, and be needle sharp. Treble hooks size 6 are large enough for most purposes.

Mount for trolling a dead bait is a single hook behind the gill on one side of the fish and treble hook just short of the waist of the tail on the other side, one hook of the treble being imbedded in the fish. Both hooks, and the wire between them, should be sewn to the bait with strong thread passing round the backbone. The mouth of the bait should also be sewn up and the trace arranged to pull from the centre. It is convenient to have ready single hooks and treble hooks on different lengths of wire to suit several sizes of baits. The loops of these wires, passed from behind through the gills to the mouth are fastened on to the trace link. That having been done the hooks are adjusted and the sewing completed. Properly adjusted the bait works with a weaving motion and does not spin. For this and other mountings of baits the Wissco wire is the best to use.

Leads and sinkers.

Leads are not ordinarily needed for trolling: an assortment should be carried for spinning, drift-line fishing, and fishing with prawn. For shore fishing on sandy bottom a mussel shaped lead is good; and among pebbles a round lead. A yard of thin line from the lead to the reel line, or cast, or trace, will enable break away to be effected without loss of gear other than the lead.

Gaff.

Should have a gape of 3 inches, be lashed to a bamboo shaft to handle of which a lanyard. See that the gaff floats or it may be lost.

A 'priest' is necessary as the boatmen never have anything handy for killing fish; a lanyard for this also.

A landing net of salmon size may be needed for estuary fishing. It, too, must float or may be lost.

Procuring bait.

Hire of boat should include a stipulation for supply of bait. Mackerel and sardines are obtained from the many boats engaged in netting off-shore. Other small fish are obtained by use of circular cast net along the shore and in any near-by creek, where also are found prawns and crabs. Generally speaking there is always trouble over bait. The men dislike the extra work of searching for bait and will evade or shirk it if they can. If separate payment is made for bait the demands are exorbitant.

Boatmen's ways of keeping bait are crude and inefficient, bait goes bad very quickly. Proper baskets are necessary for prawns; a packing case with holes for circulation of water is best for live bait: a stone in it to make sink. The box and basket are let over the side to keep bait fresh and lively. Prawns must be on shady side of the boat: fish too if possible. Bait that is dead is best carried in a packing case filled with wet sand. If left to lie about in the boat it soon becomes bad and useless.

Ground bait is useful at times. Crushed crabs, or any crushed fish mixed with boiled rice and trailed from the boat in an open-mesh sack will do; or it can be sunk to required depth, Oil sardines squeezed and kneaded beneath the surface and allowed to drift down tide will serve; also such bait put in a string bag and weighted to hang from stern of boat. All of these will bring fish on the move to find the food it leads to—the angler's lure!

Cuttle fish and octopus tentacles are good bait for drift-line fishing.

Sundries and spares.

Anti-sunburn cream; brass wire, annealed, of several thicknesses; Carborundum stone hook sharpener (if it gets gummy from use, soak overnight in petrol and burn off the absorbed spirit —becomes as new); knife; needles; thread, red, black, white; pliers and wire cutter; watch repairer's vice; screwdrivers; files; oil (3 in one); oil—fish oil, on hooks and wire helps against rust; floats, fine quill for mullet, tapered cork for prawn, best colour is black above water with white water line; scarlet wool; white feathers; wax and silks for rod repairs etc.; leads of assorted shapes and makes and weights; lead wire; hank of whipcord; a 150 yard heavy cotton handline for sharks and big perch; 2 or 3 shark hooks; leather rod belt with socket for butt; soldering materials; line winder of large capacity (about 10 ft. at turn of handle).

A packing case with leather cushion; this is necessary in a dug-out as a seat and box to hold tackle and sundries. Lid should be arranged to keep out water, and the box zinc lined. A small piece of board on which to cut baits will obviate mess from such operations.

Spares should include plenty of various kinds of hooks; swivels; spoons etc., trace wire of several thicknesses; spoons and swivels can be cleaned by putting into a shallow dish of tomato juice; or immersed in a solution of salt and vinegar; dry with a soft cloth; solution can be kept for further use.

Rest House etc., Accommodation.

The following list indicates where accommodation can be had within reasonable distance of possible fishing localities. Places where there are Estuary mouths but no accommodation are also shown. At these it would be necessary to camp.

At many of these out-of-the-way Rest Houses very little is obtainable locally so it is essential to have with one camp bed: mosquito net; bedding; basin; tiffin basket with cutlery, plates, cups etc., food containers, box of essential stores, lanterns, k. oil, and an Icmic (charcoal) steam cooker.

Marmugao ...	Spencer's Hotel.
Karwar ...	Grand Hotel
Gangāvali ...	Estuary.
Tadri Creek ...	Do
Honavar ...	Estuary and islands
Coondapoor ...	Large Estuary.
Hangarkatte ...	Do. and P.W.D. Bungalow.
Malpe ...	Islands. Local Fund Rest House about 3 miles inland.
Kap ...	Do. do. in village on main road.
Mangalore ...	Netravati River and Estuary Municipal Rest House and P.W.D. Rest House

Kāsaragod	Estuary Chandragiri River. Local Fund Rest House.
Nilashwar	Estuary and backwaters. Local Fund Rest House.
Payangadi	Estuary below Mt. Dilli; Local Fund Rest House inland on hill above river. Ry. Bridge, Bahmin.
Cannanore	3 Hotels 'Seaside', 'West Cliff', 'Savoy'. Valaipatanam Backwater and Estuary 7 miles north by rail. Bridge, Bahmin.
Tellicherry	P.W.D. Rest House; also The Tellicherry Club.
Mahe	Several Boarding Houses; possibly the Postmaster could inform.
Elattur	Estuary.
Calicut	Beach Hotel (in Old Malabar Club).
Beypore	Large Estuary. Local Fund Rest House.
Ponnani	Estuary, P.W.D. Bungalow.
Cranganur	Estuary and Backwaters.
Cochin	Malabar Hotel (Spencer's) on Willingdon Island.
Quilon	Rest House on main road. Under-sea rocks few miles to west, and bar to backwater and lake outlet 7 miles north.
Muttam	No accommodation.
Cape Comorin	First-class Government Hotel, fully furnished electric light. Arrange by letter with Butler in charge for accommodation. Much fishing done by native fishermen using catamarans. Should be excellent sea-angling if suitable sailing craft available or procured from elsewhere. Language Tamil. Muttam about 12 miles north.

For occupation of Local Fund Rest Houses apply to President of the District Board at H.-Q. Town of the District.

For Municipal Travellers' Bungalow apply Chairman of Municipality concerned.

For P.W.D. Bungalows apply to the Collector of the District.

7. EAST COAST SEA-ANGLING LOCALITIES

By Sri E. K. Mahdavan, B.A.

Assistant Director of Fisheries (*Inland*) *Central, Madras*

Locality	Fish
1. *Tuticorin*. Fishing by sailing boat inside Harbour, Steamer anchorage, and adjacent Islands. P. W. D. Bungalow.	Cock-up, Bahmin, Kalawa (*Lethrinus*), Velaimeen (*Lutjanus*), Seppili (*Epinephelus*), Parai (*Caranx*). Season: June to August, December, January.
2. *Kilakarai*. Accessible from Ramnad. Old Port Office affords halting facilities.	Important centre from which special swift country sailing craft set out across the Gulf of Manaar, right up to the coast of Ceylon, trolling for seir (*Surmai*) with hand lines baited with sardines, coconut rinds, and rag lures. Season: May to August.
3, *Pamban Channel*. Accessible from Mandapam Railway Station, or Pamban Railway Station where Travellers' Bungalows are located.	Handlining by local anglers in the evenings, during December, from the viaduct for Cock-up. Stiff rod necessary to play the fish away from the standstone blocks, preferably from boats on the Southern side. Carry plenty of spares as breakages are to be expected. Live prawns best bait. Also plenty of *Chorinemus* at Kundugul Point. Bahmin caught during north-east monsoon close in-shore in shallows inundated by the tides. Season; Cock-up, November to January, Sea Perch, June to August.

Locality	Fish
4. *Krusadai Island.* Fisheries Research Station. 5 miles from Pamban Railway Station. Apply for permission from Assistant Director of Fisheries (Marine Biology) West Hill.	Perches, especially *Pristipoma* around coral rocks to the north in Kundyal Channel. Boat rods best, with Nottingham reels. Cuttle fish strips—a very good bait in the evenings. Half-grown sharks in shallows at Sandy Point could be caught with Tope fishing tackle. Season: June, July, August.
5. *Dhanushkodi Pier.* Well-known to passengers to Ceylon. Local Fund Choultry.	Cock-up in the evenings from Pier. Shoals of yellow-tailed mullets during February and March could be ground-baited as at Mauritius and caught on bread pellets. Salmon gut to be used. Season : June to September.
6. *Talaimanaar Pier.* Well known to passengers to Ceylon.	Large hauls of Cock-up on live prawns from the pier during the season: June to September and November to January.
7. *Attankarai.* 3 miles from Ochipally Railway Station.	Cock-up and Bahmin during April and May.
8. *Sethubhavachattram.* 5 miles from Peravuruni Railway Station.	Cock-up and Bahmin during April and May.
9. *Adirampatnam.* Railway Station of same name	As above.
10. *Velankanni.* Well known Roman Catholic pilgrimage centre. 4 miles from Negapatam Railway Station.	Large numbers of Yeri (*Chrysophrus*) caught on live prawn from the bridge nearer to Velankanni after North East monsoon. Bahmin, Cock-up, and Indian Tarpon (*Megalops cyprinoides*) in same river nearer to that.
11. *Annaikkaranchattram.* 3 miles from Coleroon Railway Station.	A bad reputation for sea snakes and eels on the Coleroon River.
12. *Porto Novo.* 2 miles from Railway Station.	Good facilities, especially in Killai oyster beds, for Indian Whiting (*Sillago*) during monsoon. Use fine gut and worm hooks baited with rag worms (*Polychaetes*). Megalops, Cock-up, and Bahmin also in season May to August, but variable. Canoe-shaped boats available.
13. *Buckingham Canal* from *Sadras* to *Kadapakkam*. Former easily accessible from Chingleput Railway Station by Bus 15 miles. Travellers' Bungalow at present (1944) not open to the public. Old Historic ruined Fort. A shark liver oil centre at Sadras and a Government fish-curing yard at Kadapakkam.	Travelling by boat in the Canal affords *Megalops* and Pearl Spot (*Etroplus suratensis*). Latter requires small hook, size 16, baited with earth worms. For the venturesome sea angler Seir, *Caranx*, Barracuda, and medium sized sharks a few miles out to sea
14. *Covelong.* 17 miles by boat from Madras.	Good fishing for *Megalops* and fair for Cock-up and Bahmin. Season: February and March, but variable.
15. *Adyar River.* Southern boundary of Madras. Local Izaac Waltons have evolved an interesting tackle for catching mullets during Feb./Mar. which is strikingly similar in principle to those used by the Maltese mullet anglers. Fish are played by wading to prevent breakages.	*Rod* 10 ft. long of well seasoned bamboo reed. *Line* 10 to 11 ft. of thin even-twisted *Calotropis* fibre floated with peacock quill pith at 6″ to 12″ intervals. Mustad No. 12 hooks (mounted on cat-gut) baited with lumps of green filamentous algae (*Spirogyra*?) and at times earth worm (well scoured).

Locality	Fish
16. *Madras City. Mouth of the COOUM.*	During the month of November there is an intensive fishing for *Sillago* (Indian Whiting). There were more than a dozen rods (of the type used for Mullets in Adyar) and the fun was fast and furious. Polichaete worms were used as bait The fish are however undersized as compared to those in the West Coast rivers and creeks during the South West Monsoon floods.
17. *Madras Harbour.*	I have it on hearsay that during normal times good fishing could be had with stiff rods for sea perches, including Cock-up and *Sparidae*, using prawn as bait. Fishing is banned now owing to War conditions.
18. *Ennur.*	Of late the Bahmin and Cock-up fishing has not been very promising. The best fishing area under the bridge is rather overcrowded during week ends. At these times hand-lining at the bar results in better catches of smaller miscellaneous fishes. The channel leading into the Salt Factory (which is not open to public) yields good catches of miscellaneous fish including Cock-up and Bahmin. The lock from near this stretch into the Canal on the North side attracts both Bahmin and *Megalops* (seasons very variable).
19. *Buckingham Canal.*	These regions which are connected to the estuaries generally afford interesting fishing for *Etroplus suratensis* the Pearl Spot. Small hooks and stiff short bamboo rods are best; with mooga silk line and thin cat-gut cast. A float generally scares away the fish. Many other smaller fry could be captured on this tackle. It might be noteworthy that fishing in the locks of the Canal may very likely be thrown open to the sporting angler by the Canal authorities. I have suggested that they should be made to record a return of the catches on each day
20. *Pulicat.* Nearest Railway Station is Ponneri, but best approached by boat from Ennur.	Good fishing for Cock-up soon after the North East Monsoon. The Lake itself affords *Megalops* and Jew fishes (*Sciennidae*).
21. *Dugarajapatnam.* 18 miles from Nayudupettai Railway Station. No bungalow so best approached by canal.	Cock-up and Bahmin after North East Monsoon. Large mullets during March and April should be tackled on a fly rod baited with green filamentous algae (same bait as in Adyar).
22. *Krishnapatam.* 17 miles from Nellore. Excise Department Bungalow, furnished, on bank of Estuary.	Fishing similar to above with the addition of *Megalops* in the creeks. With suitable rod and tackle big sharks can be caught. Some very large Cock-up have been caught here. There is a good inlet run when tide coming in. Then Bahmin are to be had on spoon and prawn.

LOCALITY	FISH
23. *Vutukuru.* 10 miles from Kodavaluru Railway Station (second Station north of Nellore).	Mouth of the Peneru river. Good fishing for Cock-up.
24. *Singarayakonda.* 5 miles from Railway Station, no bungalow.	Good fishing for Cock-up ; December as well as June/July.
25. *Vetapalem.* Creek 4 miles from Railway Station.	Similar to above, with plenty of mullets. December as well as June to July.
26. *Kottapalem.* Mouth of the Kistna River about 30 miles by road from Masulipatam.	Cock-up, Bahmin, *Megalops*, and several perches. Seasons as above.
27. *Masulipatam.* Good bungalow and stores. Local Fund Rest House near Railway Station East side of the town; has electric light installed.	Good boats and deep sea fishing for Seir, Tunnies, *Elacate nigra.* Season; June to August. Broad beamed deep sea boats available.
28. *Collair Lake.* 5 miles cross country from Kaikalur Railway Station where Travellers Bungalow. Guidivada Bhimavaram Railway Line.	Cock-up after North East Monsoon. Evidently attracted by the tremendous prawn fishery here.
29. *Coconada.* Good P.W.D. bungalow and stores.	Fishing somewhat similar to Masulipatam. June to August. Boats as at Masulipatam.
30. *Pentakota.* 7 miles from Tuni Railway Station.	Cock-up. June to August.
31. *Vizagapatam.* Good hotels 'Sea View' and 'Beach Hotel', both in Waltair 5 miles from Vizagapatam Town and Harbour.	Cock-up and other sea perches. Season : June to August.
32. *Sonapur.* In Orissa but nearest Railway Station in Madras-Ichchapuram. 10 miles. No bungalow, but obliging village Munsiff, and good oysters.	Bahmin and Cock-up, with numerous Cat fish and Jew fish.
33. *Gopalpur.* Great resort for bathing, 9 miles from Berhampore Railway Station.	A few Cock-up and smaller fry in the creek.
34. *Ganjam.* A forgotten centre of the Old East India Company days with its old Cemetery and crumbling brick Fort.	Small Cock-up and *Megalops* near the old mouth of the River Rushi-Kulya. A Government Fisheries Hut near the Road Bridge. Season : November to January.
35. *Ram-lanka on Chilka Lake.* Near mouth of Chilka chala. Nearest Railway Station, Huma, about 10 miles away.	Good fishing for Cock-up and Megalops. Season ; November to January.
36. *Rambha—on Chilka Lake.* Near Railway Station.	Good fishing for Cock-up and *Megalops.* Season : November to January, but very variable.
37. *Khallikota on Chilka Lake.* Balugaon do. Kalupara Ghat do. Balipatpur do.	The Raja should know about the *Megalops* and Cock-up. This area is sadly over-fished with nets and traps. During the winter plenty of ducks and other water birds.
38. *Puri and Kunarak.* Well known for sight seers.	Cock-up; but the chief attraction is the Temple ornamentation. The mouth of the Astrang river some miles to the north is however well worth a visit.
39. *Sandkut.* A Bungalow owned by the Raja. Apply Manager-in-charge, Kuganaj Estate.	Good fishing for Bahmin. In November 1940 saw them scaring the mullets on to the mangrove banks and actually snatching them from the mud (clear of water).

Locality	Fish
40. *Kujang*. On the Mahanadi 40 miles by road from Cuttack. Raja's Bungalow	Great fishing for Cock-up, after the Monsoon, a few miles below.
41. *Chandipore*. Travellers Bungalow. Where the tide recedes for miles. About 12 miles from Balasore.	Good fishing from country craft for Cock-up, etc. in deeper water. Season November to January. A few flat-bottomed boats available. Local fishing mostly with stake-nets.

SOME REMINISCENCES OF SPORT IN ASSAM.[1]

BY

H. G. H. M.

Part II

(*Continued from page* 209 *of volume* 45).

It may be as well, before proceeding to relate further shooting reminiscences, to say something about the rules regulating the sport of hunting tiger with the aid of elephants. In this matter of the right way and the wrong way to do things the Rajah of G— was very particular, and rightly so, as carelessness in the handling of weapons has resulted in not a few fatal accidents.

A basic and inviolable rule is that, when the rifle or gun is removed from the howdah rack, or carried in the hand when shooting from a '*chaujamah*', or a plain pad, it must be held—until actually aimed and fired—with the muzzle pointing upwards. This rule is insisted upon even during a scrimmage such as takes place on the tiger attacking the elephant; and also under the very dangerous and exciting circumstance when the tiger is on the elephant's rump and endeavouring to get at the occupants of the howdah. A weapon should be kept at safe, or uncocked if a hammer arm, until just before firing, and returned to safety before being replaced in the rack or held (as on a pad elephant), ready for further use. When changing from pad to howdah and vice versa, also when mounting or dismounting from elephants, it is very necessary that all weapons be unloaded.

On one occasion I remembered that I had forgotten this, and went back miles to find the howdah elephant and unload my rifles left in the rack. I became a privileged person in that, when using a very heavy rifle, I was permitted to stand in the howdah with the rifle breech open and the weapons resting in the howdah rail, for I found the strain on the muscles of the right hand, holding a heavy weapon with the muzzle upwards and the butt on the rail, to be very great if continued for any length of time. 'Yes' said the Rajah, 'you may try that and see what the mahouts say.' As soon as the muzzle came down on the rail the mahout said 'Sahib !' and pointed upwards. I asked him to stand up and see how safe the method was, and then he grinned and said, 'Well, it is you, and we trust you, you can do as you like.'

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[1] It is regretted that through an error the author's reminiscences have been associated with the 'Raja of Goalpara'. The second line of paragraph 3 of Part I of this article, published on page 199 of Vol. 45, No. 2, should read :—
'Rajah of G— until I was posted to the Goalpara District.'—Eds.

This brings home the point that the mahouts are very critical; and once they distrust a sportsman it is good-bye to his chance of bagging a tiger. The next day the Rajah said to me, 'I see the mahouts have granted you permission; you are a privileged person: not to everyone would they accord their consent in such a vital matter.'

As in small game shooting under ordinary circumstances, so in tiger shooting from elephant-back, shots across the front of the line must never be taken. On one occasion a relation of G's Dewan shot across my front at an imaginary tiger and was exceedingly angry when his elephant was ordered out of the line; but he had to go. The Rajah made no exceptions, and took the strongest action, whoever the offender might be. In connection with this occasion there was an amusing incident. A great friend of the Rajah's, who did not shoot, was always to be seen in the back seat of the Rajah's howdah. Some of the other guests were laughing, and laughed all the more when I asked what had caused the offender to fire across me, for I had not seen a tiger and the beat came through without putting up any animal. One of them remarked, 'Look at G's friend: see his ears twitch!' Then I noticed that he had, in a marked degree, the ability to move his ears about in the way small boys often do when making grimaces. The offending sportsman, when asked what he had fired at, replied: 'Why a tiger of course, I saw its ears twitching,' hence the shot across my front. After that it was always a great joke, and the Rajah's friend would violently twitch his ears when a tiger was missed.

Another strict rule is that when the line of beating elephants is approaching from the front no shot must be taken at a distance of more than about twenty yards: the closer the better, for longer shots may endanger the lives of the mahouts. Many accidents have happened from non-observance of this rule, and doubtless there will be many more; yet, if it is adhered to, no such accidents will occur. There have been many extraordinary accidents owing to glancing or ricochet shots. The nearer the shot is taken the less chance is there of the bullet going astray.

Unless general shooting is proclaimed by the Master of the Shoot no one may fire at any thing but the tiger. Birds flushed ahead of the line—jungle fowl, peafowl, partridge may all be indications of a tiger on the move; so also the 'hullee' of some animal, a sambar or other deer, or a pig. All such signs have to be watched for, and experience soon teaches the sportsman what is indicated by them. Though the beating line may be a long way off yet a flushed bird may show that the tiger is close by, so one has always to be watchful, vigilant, with the mind concentrated on the business in hand. Right on the heels of a breaking sambar may be the tiger, for when alarmed all animals are thinking of their own safety and way of escape and indifferent to the larger carnivora which, they well know, are not hunting them.

No chance shots may be taken; no firing at moving grass; for if you fire and kill a deer, or other animal, you may ruin the chance for the tiger and, moreover, may perhaps not again be asked to a shoot by that particular host.

A howdah elephant is often placed in the beating line. The occupant may not fire at a tiger, for by doing so he may spoil any chance of the tiger being shot. His job is to act as a beater, to assist in directing the line, and to drive the tiger to the waiting guns ahead.

On one occasion I was guilty of killing a tiger from the beating line but it was under exceptional circumstances, and G said I was acting rightly. This was the largest tiger I have shot—over ten feet, with a short tail. I may relate the occurrence later; but it was pleasing to me when the Rajah led the cheering; and the mahouts cheered with a will for they believed this animal to be a man-eating tiger. It was confirmed the next year because all killings of people in that district had ceased.

It is very often that the beating line views the tiger, and I recollect Mr. L, afterwards Sir A. L, Governor of Assam, taking stones in his howdah to throw at the tiger and make him move on. Before he left Assam he had killed perhaps fifty tigers. He frequently used a .405, the weapon the late Theodore Roosevelt called the 'medicine gun for lions', and found it an efficient weapon for howdah shooting.

When your elephant has been placed at a particular spot you must on no account move from that spot, for by doing so you may not only be incurring danger to yourself and your mahout, but may let the tiger escape.

Sometimes, when there is a large expanse of heavy grass, elephants are used to trample a clear space, along the hither side of which the guns are placed. The line of beating elephants forces the tiger towards the cleared tract and the animal, not knowing it is there, will afford a shot as he hesitates on the further side of it. Always must the guns be on the hither side. That, of course, is common-sense, and a rule even in small game shooting, for shots at animals and birds scurrying past you unexpectedly from behind are very chancy, and you cannot face the other way as you would see nothing before it was right on top of you.

In Assam, and also I am told along the Terai, as the jungle country along the foothills of the Himalaya is termed, are swampy and boggy places into which elephants cannot go, and indeed will not go, for they know the danger of it. When tiger make such places their haunt they are exceedingly difficult to get at. To meet this kind of situation G. devised a method of which I have not heard, or read, anywhere else.

He had a supply of 12 gauge 'firework' cartridges which could be fired from an ordinary shot gun without fear of damaging the barrel. When fired the charge will rise to a height of sixty or seventy yards and then burst, producing a wonderful firework effect. So also, when fired into cover, it produces an effect highly discomfiting to the tiger! The method was for two howdah elephants to walk on each side of the boggy patch, the firework cartridges being fired into the grass during their slow advance. Eventually these unwelcome and unusual sounds start the tigers moving, for in such cover they are often in pairs, and once the animals are discovered by the 'hullee' of the grass to be roused, it is fairly easy to keep them on the move, and eventually drive them to the guns on the waiting line of elephants at the further end.

It could be known by pug-marks in the swampy ground that the game was 'at home', and the animals were kept inside the cover and prevented from breaking out to one side by a shot or two ahead of the 'hullee'. I have seen this method successful over and over again. The beating elephants and their mahouts like it, for there is less exertion and they see all the fun.

Sometimes tigers slip out of a beat to one side or the other when being hunted in ordinary cover, and their manoeuvre is often given away by excited twitterings of small birds and calling of jungle crows. On the very last shoot I was on, a crow kept flying from tree to tree—small trees little larger than shrubs—plainly saying, 'Here he is, here he is!' and on this accurate information a fresh beat was quickly arranged and the tigress shot. Sometimes the tiger, having heard the sound of an approaching hunt, will slip off to gain a more undisturbed locality and will be given away by all sorts of birds, and alarm calls of the smaller deer. Of the birds the babbler family, 'Striped squirrels raced, the mynas perked and picked, the seven brown sisters chattered in the thorn,—' are one of the most reliable of these aids to the hunt, for they persistently follow the tiger, scolding all the time. He cannot escape their vigilance. When tiger and panther and the wild cats sleep they are not molested, only when on the move are they given away.

The reader will be tired of nothing but tigers so I will relate an exciting elephant experience and return to the tigers later on.

ELEPHANTS

We had toured through the Garo Hills, my wife and I with our two children, then quite small, and had been walking until we reached Damra. It was winter time, and between Damra and Goalpara good duck shooting was available. When tired of walking in the hills Douglas and Dorothy used to be carried on a Garo's back in a basket supported by a strap going across the forehead: even grown-ups are carried in this way by the sturdy hill-people. At Goalpara we boarded the river steamer. The trip down the Brahmaputra to Dhubri is a very enjoyable one and we always hoped the steamer would run aground, for if this occurs it takes perhaps three or four days for another steamer to arrive and pull the ship off the sandbank. A rest of a few days on the river craft is always appreciated, for the food, at any rate in those days, was good, as also the accommodation. After a day at Dhubri we crossed the river by ferry to Fakirganj and from there went on to Fulbari whence, after a short stay, we proceeded to Hallidaygunj.

Elephant catching was in progress near Fulbari and we saw some of the newly caught animals. It was mostly done by 'mela shikar', that is, no stockades had been built and the wild elephants were caught singly. There was one baby elephant caught only a few days previously and this little creature thought it great fun to undo one's boot- or shoe-laces; very pretty to watch and highly amusing for the children. The people responsible for the taking of this small elephant said that had they not done so it would have died, or been killed by a tiger, and that it was of no advantage to them to captain it as if cost a lot to feed and would be of no value for a number of years.

The roads were in a dreadful state but passable by the old tin Lizzie brought along from Dhubri. Hallidaygunj Inspection Bungalow is on a small hill so I backed the car into a sheltered place off the road and left it there covered by a tarpaulin. Next morning villagers came to me saying that a rogue elephant had killed one of their buffaloes, and asked me to shoot it. I thought it might not be a wild elephant but one of those belonging to the elephant catchers, in which case the killing of it might mean a very large sum as compensation. That afternoon they again came to me and said, 'You would not shoot the elephant and now it has killed two men whose lives would have been saved had you listened to us.' Now I felt fully justified in going in pursuit of the beast so, taking my .475 rifle and some cartridges, went with the men and saw the two bodies being taken to the village in a bullock cart.

I followed the tracks of the killer until it became dark, and then returned to the bungalow. Early next morning we packed up and went down to the car, finding the elephant had been quite close to it; why he had not attacked it was difficult to say. We drove to Mankachar, the .475 ready for action if needed, but saw no sign of the animal which was evidently keeping to the hills. After tea with the Mauzidar we pushed on to the ferry which takes loaded cars across the river, and landing on the other side saw things wrapped in matting, and asking what these were learned they were the bodies of three men the rogue elephant had killed. One was a tailor of Mankachar, the place we had just left The elephant, they said, was following the main road and was on its way to Garobada, and for all they knew might be in the jungle along the road we were travelling. Though I said nothing I was fairly terrified as there would be 3 miles of a mud road and no possibility of turning: and glad and relieved I was to get into the bungalow at Rangapani. The building was not much protection, for an elephant could have easily knocked it down. I had thought that the cartmen, learning of the killing of the three men, would not have faced that length of road, but they came on to our great relief and comfort.

Next morning we could obtain no definite information so drove on to Garobada, the .475 affording a comfortable feeling of security. Nearing a bamboo bridge which is renewed every season after the rains, a Policeman ran into the road with violently waving hands and gave the news that the elephant had just gone into the jungle this side of the bridge. The safest thing was to get on to the bridge as speedily as possible for no elephant would venture on such a structure. Learning soon that the dreaded beast was across a small jungle stream we hurried on to the foot of the hill on which is the bungalow and there parked the car in a safe! spot, my wife and children went up to the house.

From the time the policeman was met all information gained was shouted from men perched in the safety of trees. There were nine men in trees, each with a gun or rifle, and I was asked to go in after the elephant and kill it; they would protect me! 'Yes,' I said, 'you will see the grass moving and take me for the elephant. Not much' or words to that effect. The cover was tall elephant grass interspersed with clumps of bamboo, so small hope of obtaining a successful shot.

There were some elephants not far off belonging to a party of elephant catchers but none of them, very naturally, would consent to giving me a mount to go after the rogue. I told the men in trees to get away from the jungle and I would go and have some lunch and think the matter over. While at this pleasing occupation some men came to say that the elephant was now out in the river and might make his way towards a 'hat' (a market held on certain days) where there would be hundreds of people, and that not more than a mile away. It was evident that something in the way of action was necessary. Already this brute had killed two men at Hallidaygunj; three near Rangapani; had met carts on the way to Garobadha and there smashed up several carts, killed two cartmen and destroyed a bullock or two; seven human beings had he already slain, and at the 'hat'—? It was a terrifying thought.

All who had seen him described the animal as a single-tusker. Taking a handful of cartridges (Solids) and the .475 I ran down to the road leading to the 'hat' and there saw the tusker in the river sporting about in the water which was about 4 feet deep at that place. Directly I showed myself on the bank of the stream he curled up his trunk and charged. His head was held very high. I sat down for the shot and tried to put the bullet past his trunk in hope of reaching the brain, but failed. On receiving the shot he screamed and went back on his haunches, but so quickly did he turn in his tracks that the second shot aimed at his chest (side) hit him near the tail: those who have not seen elephants in the wild state can have no conception of the rapidity of their movements on such occasions as this. I only had time to ram in one cartridge and fire as the beast was disappearing into the bamboo on the further side of the stream. This shot fairly knocked him over, but only temporarily. I heard the crash but did not actually see him fall. My wife and children up on the hill saw and heard the whole affair: the charge, the scream, the backing on the haunches, the second shot, the third shot, and the fall. Servants and Garos standing on the hill also witnessed the whole affair; such an exceptional scene as can have but rarely been laid out as a spectacle for spectators.

Had I only known it at the time I could have gone along the road until opposite the car and then got close to the bank without being seen. The shot would have been a close one and from safety, as there the bank was very steep. However I did not know all that and had to act quickly and take my shot at about 30 yards.

There was no elephant I could use for following the wounded animal. One of the elephants was a 'Jung Bahadur', but not such a grand animal as G's elephant of that name. Had he been available the hunt after this rogue would have been a highly exciting business, and a successful one also. Hurrying down the road I found the elephant had crossed about three miles on and I followed on some miles further, but got no news of him. He was found dead near a Garo village fifty miles away and Mr B, the Forest Officer, sold the tusk for me for Rs. 400.

Those who have been charged by an elephant will tell you that the on-coming animal appears as if a great railway engine is advancing on you and that it is impossible to stop it. That is what it feels like even though experienced several times. Every time you feel as if nothing could stop the huge thing. The charge usually takes place from grass jungle and you do not see the animal until it is almost on top of you, so all the more do you feel that it cannot be halted. That is my own feeling. With all dangerous game I am terribly excited and frightened until I am actually taking aim and then I become perfectly calm and able to shoot accurately. As soon as the danger is over reaction takes place with me and the whole of my body trembles for minutes. I have never killed a charging elephant dead in its tracks but have always been able to stop and turn him. It seems to me that a charge of shot into the turned-up trunk would stop a charge, for elephants greatly dislike their trunks being hurt; watch a mahout make an elephant obey him by jabbing the trunk lightly with a spear: but I will let someone else try the shot gun experiment.

Padre P of the American Baptist Mission located at Tura, Garo Hills, was keen on big game shikar. I had obtained permission to kill two rogue elephants, a tusker and a mukna which always went about together. The Garos came to say that these two were giving trouble near a village five miles away, so I wrote to the Padre and asked him to come along and he should have the first shot. He arrived with his .400 H.V.D.B. H'less express and we started off, I with my .475. Some distance from the village the Garos began to track, and after about an hour we arrived at a small stream which was not fordable. As I am unable to swim I held on to two Garos who swam through the deep portion with me. Having had a rest and dried ourselves we slowly followed the tracks up a hill, on the top of which we found a flat portion of ground covered with lantana having among it a few open spaces. Soon we spied the two elephants standing in the shade of a tree. The mukna was clearly visible, but not the tusker. P, moving a bit to one side said 'I can see the tusker', and before I could stop him dived into, or rather under the lantana. The mukna backed and the tusker moved round the tree. P, who of course could not see what was going on, got very near the mukna—actually within ten feet of it!—and the beast rolled up its trunk, put its head down and was about to charge into the lantana when I decided that the Padre was in a very dangerous position and fired from the side to reach the brain. I was fifteen paces away and the solid bullet, though not reaching the brain, knocked the animal over. P stood up immediately and told me he had, before it fell, fired a shot into it at very close range. As soon as he could he came back on his hands and knees, got up a small tree and stood on a branch no thicker than one's arm and started firing shot after shot into the fallen elephant's head and chest.

He suddenly said that his rifle was misfiring and I handed my .475 to him. This also misfired and then the elephant stood up. I was now behind a large forked tree with the supposed disabled weapon and put in two cartridges in the hope that perhaps the rifle would act. Then P. actually succeeded in getting off a shot which, fired from above, found the brain and the beast fell dead. The poor beast had eleven bullet wounds, and when standing blood was streaming down its chest, a terrible and piteous sight. When an organ that is not usually protruding, protruded it was certain that the beast was dead. This was P's first elephant. It turned out that he had been loading the right barrel and pulling the left trigger; then he would load the left barrel and pull the right trigger. In excitement funny things happen. There was nothing the matter with the rifle. When my weapon was examined it was found that the right striker was broken.

It will be noticed that this story furnishes at least one moral: one's rifle should be carefully examined before starting after dangerous game.

On another occasion we had permission to shoot a large tusker and, to cut the story short, P took the shot and immediately started running; he had not got very far when he naturally fell, tripped up by a creeper. He persisted in running away after a shot and I could not get him to give it up. He did it every time, and fell every time! This time the elephant was only stunned and we never came up with it again.

That little tale leads up to this one. A rogue makna elephant had been proscribed by the D.C. Garo Hills and three of us—Mr. W, I.C.S., the D.C., Padre P and I started out to hunt it. The only one with any experience was myself. I made a bad mistake and we were lucky to get out of the difficulty as easily as we did. The mistake was in following the beast in very dense grass jungle. I should have gone round the hill until it was certain where the animal was and then planned an attack on it. As it was I followed the tracks into difficult jungle well knowing that an animal, especially an elephant, is likely to return on its own tracks. This is what happened, and it is fortunate we saw the upraised trunk reaching for some food. I immediately put P, who was to take the shot, into position near an opening in the cover where it was certain the elephant would pass. He came into the clearing as expected, affording a clear side shot at the side of the head to reach the brain. This is supposed to be an easy shot and a sure one, but I have seen it to be not a sure one for the bullet may strike a projecting bone and glance off in a wrong direction, or the cancellous bony structure of the skull may divert it. The shot on this occasion was a very close one, and the Padre discharged both barrels of his .400 H.V. rifle simultaneously. The animal fell over dead—but we did not know it was dead. P, after firing, did his usual sprint and ran away to, as usual, catch his foot in a creeper and fall sprawling. W jumped backwards at the shot and fell into thick lantana which supported him, but he was in a difficult position had anything happened unarmed as he was for he had only come out to see the fun. As the animal fell a fairly thick bamboo hit me on the head and knocked me down. Fortunately the elephant was dead.

When the usual sign proclaiming death was seen we walked up to examine the beast. It was seen to have a number of bullets just under the skin—projectiles from native weapons, so no wonder that it had turned rogue. By the wound on its head we thought that both the bullets had reached the brain, but it was later found that both had been deflected and that the cause of death was injury to the spine—a badly fractured spinal vertebra: an altogether very extraordinary affair; and, 'all's well that ends well!' The bullets used were soft nose; and not solid as are usually used for elephant.

BUFFALO

Some villagers from across the Brahmaputra came to the D.C. Dhubri, Mr. H, I.C.S., to say that a wild buffalo bull was giving them a great deal of trouble, having killed some of the tame bulls and lately taken to chasing the people. H. sent word to S. (Forest Officer) and me suggesting we should go to the assistance of the villagers, who would give all help in the matter.

These single wild buffaloes—we may call them 'Rogue Buffaloes', become very dangerous to villages where tame buffaloes are kept. When I was in the Garo Hills I had to examine a man who had been killed by one of these 'rogues'. The buffalo had got the body of the man up against a bank in such a position that he could use the massive bony forehead, which is about eleven inches wide between the horns, to the greatest advantage. The result, propelled by the enormous strength of an animal weighing near a ton, can be imagined. The man's chest was flattened and nearly all the ribs in the body had been broken. A gruesome sight.

S. and I each possessed .475 H.V. rifles. We set out as soon as we could and crossed by ferry to Fakirganj. There the villagers put us into a bullock cart and after a few miles, the track being deep in mud and slush, we were transferred to a cart drawn by buffaloes. When this form of conveyance could take us no further we got into a dug-out canoe and were propelled by means of poles along miniature canals among the rice fields. The water was waist deep and in some places deeper. S was a man of over six feet and much felt the aches and pains of being doubled up with his knees touching his chin, expressing his discomfort in very forcible terms. The dug-out wobbled so much that I realized it would be almost impossible to shoot from it. We tossed for the shot and I won, so prepared for action. I loaded with a soft nose bullet in the right barrel and a solid in the left. S pinned his faith on solids so loaded accordingly.

After winding about the fields for about half an hour the bull was seen to emerge from grass jungle about a hundred yards away and at this distance the horns seemed to be very good. S remarked that they might even be better than those of a buffalo he had shot in the Garo Hills the measurement of which was little less than the record for Assam. When we had killed the animal we found however that the horns were little more than the average: so much for appearances at a distance.

When the rickety dug-out had been manoeuvred to within perhaps fifty yards of the bull I asked the boatmen to try and get head on and steady the boat, so that I could place my head on the spot on the animal where the bullet should hit. The men did not keep the craft steady by ramming the poles into the mud as they should have done, as they wanted to be able to get away as quickly as possible—they knew their beast!, so kept in deep water. The boat caused the rifle to wobble all over the place so there was nothing for it but to sight as is done when shooting from an elephant and bring the muzzle of the weapon up from below and press the trigger when the bead is as near as possible where it is wanted. To the shot the bull fell over on its side but was only put down for a small count, for it began to rise. I opened the breech to put in another soft nose but as I did so the dug-out lurched over and out fell both cartridges. Stooping to pick these up the cartridges in my shirt pocket also fell into the bottom of the boat in which was several inches of water. S being behind me was unable to see what was going on and asked what the something was I doing. I told him he had better use his own rifle instead of spending time and energy in back-chat. He fired one shot and the buffalo remained standing, a second one and the beast walked a few paces forward. Now I was ready with a soft nose bullet and over went the bull. It is well known that a wounded animal does not feel the shock of subsequent wounds to the same extent as the first one. The first shot is the important one, and in this case it was amply proved. The soft nose bullet twice felled the beast, whereas the solid bullets did not knock it over. We discovered that both S's solids had passed clean through the body of the buffalo and out the other side, whereas the soft nose bullets had remained in the body. To obtain the full shock the bullet must remain in the body struck, and the greater the surface struck the greater the shock. All four bullets struck the side of the chest—there was no end-on shot.

The villagers cut up the animal and feasted for days. The moral of this shikar was that cartridges should always be carried in a pouch divided to take the rounds upright, and separated from one another, and the pouch worn on a belt. The carrying of cartridges loose in one's shirt pocket and that not buttoned or in coat or trouser's pocket is all wrong for several other reasons and is not a sensible method. It has occasioned loss of coveted trophies and even fatal accidents.

It was near Rewak, a place in the centre of the Garo Hills and beloved of all sportsmen and anglers, that S. shot the buffalo with the very large horns. It was not very glorious shikar S.

said, for the shot was from elephant back and the buffalo did not know that the elephant, which of course he took to be a wild one, carried death on its back. The head was just short of the record and when S was serving during the Great War he gave the trophy to the Mess of the Regiment he was serving with. The Rewak locality was renowned for buffalo with fine horns and it was near there that Captain M shot one with head a trifle larger than that obtained by S. It was in the habit of consorting with tame herds and had killed several domestic bulls. M waited at the edge of the jungle for return of the tame herd from their grazing and bagged the wild bull by a chest shot from his .475 rifle. The solid bullet was found somewhere near the tail. There was at that time a small outpost of the Assam Rifles not far from Rewak but it has since been abolished, much to the detriment of the sport of the Assistant Commandant who used to greatly enjoy the excellent fishing and shooting in that locality.

In my early days in Assam I was the owner of a .450 D.B.H. less H.V. rifle by Jeffrey and at the time of the following encounter had little experience in shooting big game and practically none with high velocity rifles. I had been told that with one of these super rifles one had only to put a bullet into the body of an animal, never mind where, and it would immediately crumple up. I soon learnt otherwise. If the shot is properly placed they are the best of rifles, but it must be so placed. With H.V. rifles of smaller bore, of which I became possessed later on, it was all the more necessary to use great care in properly placing the bullet. Coarse shooting with any calibre of rifle is much to be deprecated. Nothing smaller than .400 H.V. should be used against tiger and the larger animals, elephant, buffalo, bison, rhino, the only exception being the .375 Magnum taking the 300 grain bullet.

My wife and I were going into country where few had travelled before, and after touring well into the hills had to make our way to parts of the Garo Hills bordering on the Mymensingh District in the Bengal Province. The only way to reach these outskirts of the hill tract was by boat. The streams were fairly rapid, and a boat had to be sent on ahead with men to erect new bamboo huts. I knew nothing of fishing and much regretted this as the various streams we travelled on must have been able to show good sport. The streams in winter were about four feet deep with fine pools at intervals. One's progress was leisurely, as the boats had to be poled up the rivers, and all sorts of jungle life was to be seen and observed close at hand. Lovely scenery, beautiful trees, varied foliage of trees, shrubs, jungle grasses, and the ever graceful bamboo. Anything in the way of wild game might be seen and we saw much that would have never been sighted other than by means of the silently poled boats. At night the boats were tied up and we occupied the comfortable bamboo huts prepared for us.

One day away from the plains we were in our new bamboo hut and went up stream with Garos to guide us as it is quite easy to lose one's way in those jungles. After about an hour the boats were tied to the bank and our guides led us off to get to a place where sambar would be found feeding on a fresh tender kind of grass of which they were very fond. Scarcely had we entered the jungle when a sambar broke away and this so frightened a plains servant who was with us that he fled to the boats, and would have dived into the river had one of the men not restrained him. There was great hilarity over this incident.

Proceeding we came across the fresh track of a lone buffalo bull and were relieved when it was found he had left the game track we wished to follow and had branched off along another one. After this the guides lost their way and as it was getting dark we returned to our boat, being glad to get to our hut before final darkness set in. I was tempted to stay a few days and try for the buffalo but decided the time could not be spared so continued our journey, to halt at Bagmara for three days inspection work. From here to Rewak is three days river journey, the arrangement being a sleeping apartment and an eating apartment built upon two dug-outs securely lashed together by bamboo ropes. In this way travelling is very comfortable and all sorts of game, including elephants, may be encountered. From Rewak we went on to Nankong a place noted for buffalo shooting. Here were also two rogue elephants which I had permission to kill. We had very nice bamboo huts on the bank of a small stream, the huts for the camp followers being some little distance down stream. About an hour before midnight the two elephants arrived in the jungle on the further bank and fed there until the early hours of the morning. It was realized that the servants' huts were too far away as, had they been attacked, it would have been difficult for me to have afforded them help.

Next morning I was taken to a place frequented by buffaloes and had just come to the edge of a clearing, with a nala at my feet to the right, when I saw, coming into the clearing on the other side, a big buffalo bull. Seeing me it at once charged. I took the shot kneeling, firing the left barrel with solid bullet when the beast was halfway across the clearing, and the right with soft-nose bullet took him in the centre of the chest at about 25 yards. I expected the animal to be knocked down but it was not even checked, and there was only just time for me to drop into the nala. The buffalo passed over the spot where I had been a moment before and carried on into the jungle for about 200 yards: then we heard moans and it was soon dead. The first bullet had traversed the length of the body and the second had penetrated to the chest and a little beyond and damaged the liver. Here was a case of two bullets failing to stop a charge, whereas the bull at Fakirganj was knocked over with one bullet both when unwounded and when wounded.

On examining this aggressive bull I found that it had been very recently wounded by 12-gauge spherical bullets; and later in the day the Garos who had been making enquiry reported that only that morning villagers had fired at it with their inefficient weapons. No wonder it was savage and charged on sight. The horns were below the average.

(*To be continued*).

BIRDS OF THE VIZAGAPATAM DISTRICT.

BY

HUMAYUN ABDULALI.

On my way back from Madras in March this year (1944), I visited friends in Vizagapatam whom I had warned of my coming under the impression that this would only take me a little out of my way. The 500-mile run northwards along the coastal plain was monotonous, but there were some striking differences as compared with the West Coast. Most of the area was under paddy and the marsh harrier was everywhere. Palmyras were amazingly abundant, closely grown palms even being used as hedges. All goats were black and the sheep a dirty brown, yielding the coarse 'red' wool of Madras. Along the sea-shore, often visible from the train, were dense plantations of Casuarina grown as firewood. (A friend in Madras talked of snipe-shooting in these plantations !)

North of the Godaveri almost every bird seen was something which the Vernay Ornithological Survey had overlooked. When I got into Waltair (a suburb of Vizagapatam port) I hustled B. into taking me over as much of the surrounding country as was possible over my 2-day stay. We shot a few cotton teal at Kondakarla, whence pink-headed duck were recorded many years ago. We ran up into the ghats 70 miles eastwards, and the country looked more and more intriguing. That magnificent tree *Cochlospermum gossypium* was in flower all over the hills, and the big red squirrel abundant and confiding. I got my first view of the red jungle fowl and there was so much to see that I came back determined to have another and better look at the country as soon as possible.

There are few places in India to which Charles McCann of the Natural History Society has not been for something or the other, but the Eastern Ghats was one of them, and we decided to do a short trip together mainly for ornithological investigations. We reached Vizagapatam on 24th May and with the co-operation and hospitality of my very good friends at Waltair we were able to cover a fairly large area in the relatively short time. We first went to Anantgiri 2,500′ where La Personne, collecting on the Eastern Ghats Survey had camped from 4th Feb. to 15th May. We were here for two days including an evening run up to Sankrametta, 3,000′. We then went up to Lamasinghi 2,500′ (Narsapatam Taluka) which is about 50 miles south of Anantgiri in the same range. These hills form the eastern fringe of the ghats which extend much further westwards into the lesser known regions of Bastar and Jeypore States and the forests of Raipur. We camped at Lamasinghi for four days, stayed in Waltair for a couple of days, including another look at Kondakarla, and then entrained for Bombay.

During this short trip we noted about 140 species of birds of which 73 had been overlooked by the Survey. Many of these

(27) are the commoner forms of the low country, which the Survey did not work. For the sake of completeness all the previous records from the district, mentioned in the Eastern Ghats report are included in this list, our 73 additions being marked with an asterisk, while a † indicates that the species (33) was obtained by La Personne but not found by us. This number includes at least 16 cold weather migrants.

There are obvious possibilities for further field work in this area—we pickled a few lizards and frogs and they fill large gaps in the known distribution—and we hope to be able to work further into the interior with more petrol and time. I would like to record our gratitude and thanks to Mr. and Mrs. B. F. Patuck without whose unstinted hospitality and enthusiasm the trip would never have been possible and also to Mr. McCann who seemed to enjoy skinning by candlelight, and whose decrepit and disreputable .22 added several interesting birds to our list.

(After this was written I went to Vizagapatam again during Christmas. Due to an unfortunate series of circumstances I was unable to get into the Hills and except for a couple of duck shoots did not go afield at all. A few notes made, however, reveal 16 additions to the last note, bringing the total of new records to 89. These together with supplementary notes on species already recorded are also incorporated herein.)

[1] **Corvus macrorhynchos culminatus** Sykes. The Jungle Crow.

Noted at Waltair, Anantgiri and Lamasinghi.

Corvus splendens splendens Vieillot. The House Crow.

Common at Waltair—on nest! Absent at Anantgiri. Two females shot during Christmas had ovaries dormant.

Dendrocitta vagabunda vagabunda (Latham). The Indian Tree-pie.

One was seen from the train at Rajamundry in March but noted as scarce at Lamasinghi.

Dendrocitta formosæ sarkari Kinnear and Whistler. The Himalayan Tree-pie.

This was noted at Lamasinghi, a small party flighting across the Rest House compound every morning.

Machlolophus xanthogenys aplonotus (Blyth). The Yellow-cheeked Tit.

Anantgiri—Lamasinghi-

Sitta castanea prateri Kinnear and Whistler. The Chestnut-bellied Nuthatch.

Anantgiri—Lamasinghi!

Sitta frontalis frontalis Swainson. The Velvet-fronted Nuthatch.

Anantgiri—Lamasinghi!

Turdoides somervillei terricolor (Blyth). The Jungle Babbler.

Anantgiri—Lamasinghi. Patchily distributed and not common. Waltair—Christmas!

Pomatorhinus horsfieldii horsfieldii (Sykes). The Scimitar Babbler.

Anantgiri—Lamasinghi!

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[1] Unless otherwise stated the records are between 24th May and 3rd June.

Dumetia hyperythra hyperythra (Franklin). The Rufous-bellied Babbler.

Anantgiri! Building at Lamasinghi!

†**Chrysomma sinensis sinensis** (Gmelin). The White-eyed Babbler.

Obtained by Survey at Sankramatta.

Pellorneum ruficeps ruficeps Swainson. The Spotted Babbler.

Common at Anantgiri. Lamasinghi!

† **Stachyridopsis rufifrons ambigua** Harington. The Red-fronted Babbler.

La Personne shot a pair at Sankrametta.

Mixornis gularis rubricapilla (Tickell). The Yellow-breasted Babbler.

Two specimens were obtained, one at Anantgiri and the other at Lamasinghi. The latter, a male, was obviously breeding. Our experience regarding the habits of this bird was quite different from that recorded by La Personne. The bird was quite common, but was always seen singly in heavy forest keeping to the tree-tops rather than the undergrowth. The call is a loud monotonous 'chweek-chweek-chweek . . .' half-way between the call of the tailor-bird and the jungle nightjar. This call would be taken up for a few minutes at a time, with almost equal intervals of silence, the bird travelling through the trees in warbler style.

Alcippe poioicephala brucei Hume. The Quaker Babbler.

Lamasinghi! A male obtained had enlarged testes and was probably nesting.

Aegithina tiphia humei Stuart-Baker. The Iora.

Anantgiri and Lamasinghi!

Chloropsis aurifrons frontalis (Pelzeln). The Gold-fronted Chloropsis.

Anantgiri!

Chloropsis jerdoni (Blyth). Jerdon's Chloropsis or Green Bulbul.

Anantgiri!

Molpastes cafer saturatus. Kinnear and Whistler. The Red-vented Bulbul.

Waltair. Antantgiri common. Lamasinghi very common. 2 young in nest! C/3.

Otocompsa jocosa emeria (Linnaeus). The Red-whiskered Bulbul.

Anantgiri very common. Flushed off empty nest. Lamasinghi common. Building.

Otocompsa flaviventris flaviventris (Tickell). Black-crested Yellow Bulbul.

Noted at both Anantgiri and Lamasinghi. A female shot at Anantgiri had quiescent ovaries.

Pycnonotus luteolus luteolus (Lesson). The White-browed Bush Bulbul.

In spite of the statement in the Eastern Ghats' report (*J.B.N.H.S.*, vol. 35, p. 759), this species was not noticed. During Christmas, a few birds were seen in low country scrub around Waltair.

† **Tarsiger brunnea brunnea** (Hodgson). The Blue Chat.

La Personne obtained this species at Sankramatta and in the Jeypore Agency.

Saxicola caprata caprata. The Pied Bush Chat.

Anantgiri! Lamasinghi! Three young in nest!

***Phoenicurus ochrurus** subsp. The Black Redstart.

Kondakarla 24th December and Waltair 29th Dec. !

† **Calliope calliope** (Pallas). The Ruby Throat.

La Personne found them common at Sankrametta in March and they had left by the last week in April.

Saxicoloides fulicata intermedia Kinnear and Whistler. The Indian Robin.

Waltair ! Lamasinghi !

Copsychus saularis saularis Linnaeus. The Magpie-Robin or Dyal.

Lamasinghi common ! Anantgiri c/5 !

Kittacincla malabarica malabarica (Scopoli). The Shama.

Anantgiri and Lamasinghi common.

Turdus simillimus spencei Kinnear and Whistler. The Eastern Ghats Black-capped Black Bird.

Sankrametta and Lamasinghi !

† **Turdus unicolor** Tickell. Tickell's Ouzel.

La Personne obtained two specimens at Anantgiri in February.

† **Geokichla wardii** (Blyth). The Pied Ground Thrush.

La Personne shot one and saw another at Sankrametta and in the Jeypore Agency in April on migration.

Geokichla citrina cyanotus (Jardine and Selby). The White-throated Ground Thrush.

Lamasinghi common !

†**Monticola cinclorhyncha** (Vigors). The Blue-headed Rock Thrush.

La Personne obtained one evidently on migration at Anantgiri in April.

***Monticola solitaria pandoo** (Sykes). The Blue Rock Thrush.

Bird roosting every evening in rafters of house at Waltair during X'mas 1914.

†**Siphia parva albicilla** (Pallas). The Red-breasted Flycatcher.

La Personne obtained a female at Anantgiri on 6th February.

Muscicapula superciliaris (Jerdon). The White-browed Blue Flycatcher.

A blue flycatcher with a white eye-stripe was seen at Anantgiri. This appears to be very late for this species. La Personne got a female at Sankrametta on the 4th April.

†**Muscicapula rubeculoides rubeculoides** (Vigors). The Blue-throated Flycatcher.

La Personne obtained a male at Sankrametta on the 2nd April.

Muscicapula tickelliae tickelliae (Blyth). Tickell's Blue Flycatcher.

Nest with four young in hole in banyan 25′ at Lamasinghi.

†**Muscicapula poliogenys vernayi** (Whistler).

Curiously, I did not notice this species, having confused it possibly with *M. tickelliae* of which a specimen was obtained. This blue-washed race is very similar to *tickelliae*, even in the hand, though the tail is appreciably longer.

†**Eumyias thalassina thalassina** (Swainson). The Verditer Flycatcher.

La Personne got it at Anantgiri and Sankrametta in February and March.

Alseonax latirostris (Raffles). The Brown Flycatcher.

Lamasinghi!

Culicicapa ceylonensis. The Grey-headed Flycatcher.

Several seen at Lamasinghi. Their occurrence at this time of the year indicates a resident race as suggested by Whistler, *J.B.N.H.S.*, vol. 36, p. 88, the Survey having collected specimens intermediate between *pallidior* and *ceylonensis* in March at Sankrametta.

Tchitrea paradisi paradisi (Linn). The Paradise Flycatcher.

Anantgiri and Lamasinghi!

Hypothymis azurea styani (Hartlaub). The Black-naped Blue Flycatcher.

Anantgiri and Lamasinghi. A female obtained had granular ovaries.

Leucocirca aureola compressirostris (Blyth). The White-browed Fantail Flycatcher.

Anantgiri!

Leucocirca pectoralis vernayi (Whistler). The Eastern Ghats Spotted Fantail Flycatcher.

Anantgiri and Lamasinghi. In the field this subspecies looks appreciably different from the typical race in Bombay.

Lanius vittatus (Valenciennes). The Bay-backed Shrike.

Sankrametta! Lamasinghi! Waltair Christmas!

***Lanius cristatus cristatus** (Linnaeus). The Brown Shrike.

Several were seen around Waltair during Christmas 1944.

Lanius nasutus nigriceps (Franklin). The Black-headed Shrike.

Anantgiri and Lamasinghi!

Hemipus picatus picatus (Sykes). The Black-backed Pied Shrike.

Anantgiri and Lamasinghi!

Tephrodornis gularis subsp. The Wood Shrike.

A female shot at Anantgiri had a 118 mm. wing and another unsexed at Lamasinghi w-119 mm. These birds appear to lack the grey tint of the southern race *sylvicola* and are probably *pelvica*.

Tephrodornis pondicerianus pondicerianus (Gmelin). The Common Wood Shrike.

A female with granular ovaries was shot at Anantgiri w-89. Lamasinghi!

Pericrocotus speciosus semiruber Kinnear and Whistler. The Scarlet Minivet.

Anantgiri and Lamasinghi.

† **Pericrocotus roseus roseus** (Vieillot). The Rosy Minivet.

La Personne obtained this species at Sankrametta in April.

Pericrocotus peregrinus peregrinus (Linn). The Little Minivet.

Waltair and Anantgiri!

***Lalage sykesi** (Strickland). The Black-headed Cuckoo Shrike.
Lamasinghi !

***Graucalus javensis macei** (Lesson). The Large Cuckoo Shrike.
Waltair in March ! Anantgiri ! Christmas Waltair !

***Artamus fuscus** (Vieillot). The Ashy Swallow-Shrike.
Waltair ! Also at Anakapalli in March !

***Dicrurus macrocercus peninsularis** (Ticehurst). The Indian King-crow or Black Drongo.

Waltair common ! Anantgiri ! Lamasinghi common. Female wing 114. Male w-141. With young out of nest ! Waltair X'mas common !

†Dicrurus longicaudatus longicaudatus (Jerdon). The Ashy Drongo.

La Personne obtained it at Anantgiri, Sankrametta and the Jeypore Agency in April, but we did not notice it. The previous species which he did not procure may have replaced it ! ?

***Dicrurus caerulescens caerulescens** (Linn). The White-bellied Drongo.
Anantgiri ! (McCann.)

†Chaptia aenea malayensis (Blyth). The Bronzed Drongo.

La Personne obtained it at Anantgiri and Sankrametta. Did we overlook it or has it gone? The absence of the Racket-tailed Drongo in this area is remarkable. Lowther found it absent in Manbhum Dist. (*J.B.N.H.S.*, vol. 41, p. 529).

†Acrocephalus dumetorum (Blyth). Blyth's Reed Warbler.

La Personne at Sankrametta and Jeypore Agency.

Orthotomus sutorius guzerata (Latham). The Indian Tailor Bird.
Lamasinghi !

Franklinia gracilis (Franklin). Franklin's Wren-Warbler.

Anantgiri and Lamasinghi.

†Phragamaticola aedon (Pallas).

La Personne obtained one on migration in Jeypore Agency on 29 April.

†Sylvia curruca blythi (Ticehurst and Whistler). The Lesser White-throat.

La Personne at Anantgiri.

†Phylloscopus affinis (Tickell). Tickell's Willow Warbler.

La Personne at Anantgiri.

†Phylloscopus inornatus humei (Brooks). Hume's Yellow-browed Warbler.

La Personne obtained it at Anantgiri and Sankrametta.

†Phylloscopus nitidus viridanus (Blyth). The Greenish Willow Warbler.

La Personne obtained it at Anantgiri, Sankrametta and in the Jeypore Agency.

†Phylloscopus trochiloides ludlowi Whistler. The Dull-green Willow Warbler.

La Personne obtained it at Anantgiri, Sankrametta and in the Jeypore Agency.

†**Phylloscopus occipitalis occipitalis** (Blyth). The Large-crowned Willow Warbler.

La Personne obtained it at Sankrametta.

†**Seicerus burkii whistleri** (Ticehurst). The Black-browed Flycatcher Warbler.

La Personne obtained it at Sankrametta.

†**Homochlamys pallidipes pallidipes** (Blanford). Blanford's Bush Warbler.

La Personne obtained it at Sankrametta.

†**Prinia socialis socialis** (Sykes). The Ashy Wren Warbler.

La Personne obtained it at Sankrametta and in the Jeypore Agency.

***Prinia sylvatica sylvatica** (Jerdon). The Jungle Wren Warbler.

A male (w-63) shot at Lamasinghi had enlarged testes and was breeding. Several were seen. Also seen in scrub round Waltair during Christmas.

***Oriolus oriolus kundoo** (Sykes). The Indian Golden Oriole.

Lamsinghi several! Also in March at Waltair and Kondasantha. May possibly breed in the hills. Waltair Christmas!

***Oriolus xanthornus maderaspatanus** (Franklin). The Black-headed Oriole.

Kondasantha in March! Lamasinghi scarce!

Sturnia malabarica malabarica (Gmelin). The Grey-headed Mynah.

Chintapalli in March! Lamasinghi! Kondakarla Christmas!

***Temenchus pagodarum** (Gmelin). The Black-headed or Brahminy Mynah.

Lamasinghi! Anantgiri!

Acridotheres tristis tristis (Linn). The Common Mynah.

Waltair common! Lamasinghi!

Sturnopastor contra (Linn). The Pied Mynah.

In March when travelling north from Madras this bird was first seen about 50 miles south of Vizagapatam. A few were noted sporadically in the low country.

***Ploceus philippinus philippinus** (Linn). The Baya or Indian Weaver Bird.

Birds and nests were seen high up in trees near Chintapalli (not carefully glassed). On the 24th May birds were building in a *Phoenix sylvestris* near Sentanagram Station (north of Waltair).

Uroloncha striata striata (Linn). The White-backed Munia.

Anantgiri! Lamasinghi building.

†**Uroloncha kelaarti vernayi** (Kinnear & Whistler): The Rufous-bellied Munia.

La Personne obtained the type specimens at Sankrametta.

Stictopiza formosa (Latham). The Green Munia.

Lamasinghi!

†**Carpodacus erythrinus roseatus** (Blyth). The Common Rose Finch.

La Personne obtained it at Sankrametta on 30th March.

***Gymnorhis xanthocollis xanthocollis** (Burton). The Yellow-throated Sparrow.

Lamasinghi. Frequent in thinner forest towards Chintapalli.

***Passer domesticus indicus** (Jardine and Selby). The Indian House Sparrow. Waltair !

***Riparia concolor** (Sykes). The Dusky Crag Martin.

On Lamasinghi ghats !

Hirundo daurica erythropygia Sykes. The Indian Red-rumped Swallow.

Anantgiri ! Lamasinghi ! Nests seen under bridge.

***Hirundo rustica gutturalis** (Scopoli). The Eastern Swallow.

Common at Kondakarla, probably this race, during Christmas.

***Motacilla cinerea melanope** Pallas. The Grey Wagtail.

At Chintapalli in March !

Anthus trivialis trivialis (Linnæus). The Tree-pipit.

La Personne obtained this at Sankrametta and a tree pipit was noted as common round Chintapalli in March, and also around Waltair during Christmas.

Anthus rufulus rufulus (Vieillot). The Indian Pipit.

One was seen in a forest clearing at Lamasinghi. La Personne obtained it in the Jeypore Agency. Low country around Waltair Christmas !

***Eremopterix grisea grisea** (Scopoli). The Black-bellied Finch Lark.

Very common around Waltair.

Zosterops palpebrosa occidentis Ticehurst. The White-eye.

Common at Anantgiri and Lamasinghi. Birds were feeding young in nest on 30th May at Lamasinghi.

Cinnyris asiatica asiatica (Latham). The Purple Sunbird.

Anantgiri and Lamasinghi !

***Cinnyris zeylonica** (Linnaeus). The Purple-rumped Sunbird.

Chintapalli in March ! Anantgiri ! Nesting at Lamasinghi on 30th May.

Dicaeum erythrorhynchos erythrorhynchos (Latham). Tickell's Flowerpecker.

Anantgiri and Lamasinghi !

***Piprisoma agile agile** (Tickell). The Thick-billed Flowerpecker.

Bird shot at Anantgiri had 62 mm. wing. Lamasinghi !

†**Pitta brachyura** (Linnaeus). The Pitta.

La Personne saw and heard it at Sankrametta.

Picus chlorolophus chlorolophus (Vieillot). The Small Himalayan Yellow-naped Woodpecker.

Anantgiri and Lamasinghi ! Wing 120 mm.

Drybates macei macei (Vieillot). The Fulvous-breasted Pied Woodpecker.

Anantgiri ! Lamasinghi ! Male wing 99 mm.

†**Dryobates mahrattensis mahrattensis** (Latham). The Yellow-fronted Pied Woodpecker.

La Personne obtained it at Sankrametta.

Dryobates hardwickii hardwickii (Jerdon). The Indian Pygmy Woodpecker.

Anantgiri wing 81 mm. Lamasinghi!

Micropternus brachyurus phaioceps (Blyth). The Rufous Woodpecker.

Anantgiri and Lamasinghi. Female obtained had a 116 mm. wing and the stomach was packed with *Crematogaster* ants.

***Brachypternus benghalensis puncticollis** (Malherbe). The Golden-backed Woodpecker.

Common in the low country. A female with wing 140 mm. was obtained at Narsapatam. The stomach was full of large black ants (*Camponotus*).

†Chrysocolaptes guttacristatus guttacristatus (Tickell). Tickell's Golden-backed Woodpecker.

La Personne obtained one at Sankrametta.

Vivia innominatus malayorum (Hartert). The Speckled Piculet.

Anantgiri and Lamasinghi. Wing 59 mm. Had fed on small ants. Often seen in bushes quite close to the ground.

***Jynx torquilla** (Linnæus). The Wryneck.

Seen at Chintapalli in March.

Thereiceryx zeylanicus caniceps (Franklin). The Large Green Barbet.

Anantgiri and Lamasinghi!

Xantholaema haemacephala indica (Latham). The Crimson-breasted Barbet.

Anantgiri and Lamasinghi! Waltair (March)!

Cuculus canorus (Linnæus). The Common Cuckoo.

Common calling at Lamasinghi. Bird shot calling had wing 223 mm. and stomach full of caterpillars and covered with fat all over.

***Cuculus micropterus** (Gould). The Indian Cuckoo.

Heard at Anantgiri and Lamasinghi.

Hierococcyx varius (Vahl). The Common Hawk Cuckoo.

The Brain-fever bird was heard at Kondasantha (March), Anantgiri and Lamasinghi.

***Cacomantis merulinus passerinus** (Vahl). The Plaintive Cuckoo.

Anantgiri and Lamasinghi. Bird obtained at Lamasinghi had a 108 mm. wing and had fed on red bugs.

***Penthoceryx sonneratti sonneratii** Latham. The Banded Bay Cuckoo.

One was obtained at Anantgiri wing 116 mm.

***Surniculus lugubris lugubris** (Horsfield). The Drongo Cuckoo.

Commonly seen and heard at Anantgiri and Lamasinghi.

***Clamator jacobinus pica** (Hempr. & Ehr.). The Pied Crested Cuckoo.

Three birds were seen at Waltair on 1st June. A male shot (wing 146 mm.) was not breeding.

***Eudynamys scolopaceus scolopaceus** (Linnaeus). The Indian Koel.

Waltair common! (Also at Kondasantha in March.)

***Rhopodytes viridirostris** (Jerdon). The Small Green-billed Malkoha.

Anantgiri several (may possibly have been *R. t. tristis*, Large Himalayan Green-billed Malkoha cf. Lowther in Manbhum Dist. *J.B.N.H.S.*, vol. 41, p. 542).

†Taccocua leschenaultii affinis (Blyth). The Sirkeer Cuckoo.

La Personne obtained one at Sankrametta.

Centropus sinensis parroti Stresemann. The Crow Pheasant.

Heard at Anantgiri.

***Psittacula krameri manillensis** (Bechstein). The Rose-ringed Parakeet.

Waltair (also in March)! Lamasinghi (female, under, wing 162 mm.).

Psittacula cyanocephala cyanocephala (Linnaeus). The Blossom-headed Parakeet.

Lamasinghi!

Coryllis vernalis (Sparren). The Indian Lorikeet.

Common at Anantgiri and Lamasinghi.

***Coracias benghalensis indica** (Linnæus). The Indian Blue Jay.

Waltair common and interested in holes.

***Merops orientalis** (Latham). The Indian Green Bee-eater.

A party of 15-20 was seen at Anakapalli and a pair at Chintapalli. Also at Kondasantha in March. Common at Waltair during Christmas.

***Merops snperciliosus javanicus** (Horsfield). The Blue-tailed Bee-eater.

Nesting in a very scattered colony in the dry vertical sides of 20′ gullies washed in laterite soil at Uplands, Waltair. One nest 4′ deep contained naked young. A female wing 130 mm. had a granular ovary, but a distended oviduct. Except for a pair at Kondakarla no other birds were seen. These appear to be the southernmost breeding records unless Rhodes Morgan's records (Ibis 1870, p. 314) of large numbers breeding in the banks of the Kistna and Cauvery are correct. Betts also refers vaguely to this bird nesting in Coorg *J.B.N.H.S.*, vol. 39, p. 602. Recent records suggest a southward movement extending into Ceylon in September-October and a northward return for nesting between April and September-October (Chingleput Dist. Mrs. Barnes, *J.B.N.H.S.*, vol. 40, p. 467; Central India, Salim Ali, *J.B.N.H.S.*, vol. 41, p. 473; Rameswaram Island, C. H. Biddulph, *J.B.N.H.S.*, vol. 40, p. 238). During Christmas these birds were absent.

Alcemerops athertoni (Jardine & Selby). The Blue-bearded Bee-eater.

La Personne obtained this at Anantgiri in February. McCann saw a large bee-eater in the hills which may have been this species.

***Cervle rudis leucomelanura** (Reichenbach). The Pied Kingfisher.

Kondakarla!

***Alcedo atthis taprobana** (Kleinschmidt). The Indian Common Kingfisher.

Anantgiri.

***Halcyon smyrensis** (Linnaeus). The White-breasted Kingfisher.

Common in the rills nesting in roadside cuttings, particularly at hairpin bends. C/5! C/3!

***Upupa epops ceylonensis** (Reichenbach). The Ceylon Hoopoe.

Very patchily distributed in the higher forests both at Anantgiri and Lamasinghi. Two were collected at 3,000′. A juvenile with a soft skull had wing 129 mm. and another wing 122. Stomach contained remains of *Cicadae*. Also seen in March. Several (subsp.?) seen in low country during Christmas,

Harpactes fasciatus malabaricus (Gould). The Malabar Trogon.

Female with soft egg in oviduct (wing 128 mm.) was obtained at Anantgiri, face patch bright cobalt blue. Also seen in Lamasinghi area in March.

***Micropus affinis affinis** (Gray). The Common Indian House Swift.

Common at Waltair, also at Bobbili.

Cypsiurus parvus batassiensis (Griffith). The Palm Swift.

Common at Waltair and the low country though relatively not nearly as abundant as the *Borassus* palm. Also at Anantgiri and Lamasinghi though the *Borassus* did not occur so high, but *Caryota urens* was present.

Hemiprocne coronata (Tickell). The Crested Swift.

Anantgiri and Lamasinghi!

Caprimulgus macrourus albononotus Tickell. Horsfield's Nightjar.

A young bird was shot dusting itself on the road at Chintapalli.

***Caprimulgus indicus indicus** Latham. The Jungle Nightjar.

Shot on road along cliffside at Sankrametta 3,500′. Testes 4×5 mm. Heard lower at Kondasantha in March, also at Lamasinghi.

***Caprimulgus asiaticus asiaticus** Latham. The Little Indian Nightjar.

Heard at Kondasantha in March.

***Ketupa zeylonensis leschenaulti** (Temminck). The Brown Fish Owl.

A female shot at Lamasinghi had dormant ovaries and a 384 mm. wing.

***Bubo bubo bengalensis** (Franklin). The Rock-horned Owl.

Heard at Kondakarla on 24th December 1944.

***Athene brama brama** (Temminck). The Spotted Owlet.

Waltair!

***Glaucidium radiatum radiatum** (Tickell). The Jungle Owlet.

Anantgiri heard. Kondasantha in March heard.

***Pandion haliaetus haliaetus** (Linn.). The Osprey.

Seen at Kondakarla on 30th December.

Sarcogyps calvus (Scopoli). The King Vulture.

Lamasinghi! Waltair!

***Gyps indicus indicus** (Scopoli). The Indian Long-billed Vulture.

Waltair and Kondakarla!

***Pseudogyps bengalensis** (Gmelin). The Indian White-backed Vulture.

Waltair! Lamasinghi.

***Neophron percnopterus ginginianus** (Latham). The Smaller Scavenger Vulture.

Waltair common!

***Falco jugger** Gray. The Lugger Falcon.

Specimen obtained over lake at Kondakarla on 31st December. Stomach contained remains of bird.

***Ictinaetus malayensis perniger** (Hodgson). The Black Eagle.

Lamasinghi!

***Haematornis cheela melanotis** (Jerdon). The Serpent Eagle.

Female shot at Anantgiri had a wing 439 mm. and dormant ovaries. The stomach contained the remains of a snake. Lamasinghi!

***Butastur teesa** (Franklin). The White-eyed Buzzard.

Lamasinghi!

***Haliaëtur leucogaster** (Gmelin). The White-bellied Sea Eagle.

Vizagapatam and Kondakarla!

***Haliaëtur indus indus** (Boddaert). The Brahminy Kite.

Waltair!

Milvus migrans govinda Sykes. The Indian Pariah Kite.

Waltair common! Lamasinghi!

***Circus melanoleucos** (Pennant). The Pied Harrier.

Kondakarla in March!

***Circus aeruginosus aeruginosus** (Linnaeus). The Marsh Harrier.

Common all the way north to Vizagapatam from Madras in March.

***Astur badius dussumieri** Temminck and Lang. The Indian Shikra.

Lamasinghi! Anantgiri! Kondakarla Christmas!

Astur trivirgatus indicus Hodgson. The Himalayan Crested Goshawk.

A female (wing 257 mm.) was obtained at Lamasinghi. The ovaries were dormant. La Personne obtained a male (wing 220 mm.) on 28th April.

***Pernis ptilorhynchus ruficollis** Lesson. The Crested Honey Buzzard.

A female (wing 400 mm.) shot at Anantgiri had a dormant ovary. The stomach contained remains of a small bird.

Dendrophassa bicincta bicincta (Jerdon). The Orange-breasted Green Pigeon.

Lamasinghi frequent!

***Chalcophaps indica indica** (Linnaeus). The Bronze-winged or Emerald Dove.

Common at Anantgiri and Lamasinghi (also in March). A male shot had testes 3×4 mm., wing 143 mm.

***Columba livia intermedia** Strickland. The Indian Blue Rock Pigeon.

Common at Vizagapatam.

Ducula badia cuprea (Jerdon). **Alsocomus puniceus** (Tickell).

The Vizagapatam Gazetteer 1907, p. 23 reads: 'In the hills the Imperial pigeon is not uncommon and a brown pigeon with a white head is seen now and again.' Ball recorded this Imperial Pigeon from Jeypore and the Purple Wood Pigeon was obtained by Mooney in the Singhbhum District where he says it is local but was noted through 'the forest tracts of Orissa southwards to the borders of Madras (Presidency)' (*J.B.N.H.S.*, vol. 37, p. 735).

***Streptopelia orientalis** subsp.? The Rufous Turtle Dove.

Seen at Anantgiri.

***Streptopelia chinensis suratensis** (Gmelin). The Spotted Dove.

Common in hills. Two birds shot at Lamasinghi had their organs dormant. Also around Waltair during Christmas.

***Streptopelia senegalensis cambayensis** (Gmelin). The Little Brown Dove.

This was noted both in the hills and at Waltair in March but not seen on this occasion. Waltair Christmas!

***Streptopelia decaocto decaocto** Frivalszky. The Indian Ring Dove.

Recorded as common round Vizagapatam in March but not noted on this trip. Waltair Christmas!

Pavo cristatus Linnaeus. The Peafowl.

The *Gazetteer* states that 'peafowl are common all over the hills, and the Savaras catch them by chasing them from side to side of a steep narrow valley until they are exhausted'. Not seen or heard though reported by shikari.

***Gallus gallus murghi** Robinson and Kloss. The Red Jungle Fowl.

Anantgiri and Lamasinghi, but not abundant. C/5 were taken at Lamasinghi.

***Galloperdix spadicea spadicea** (Gmelin). The Red Spur Fowl.

Lamasinghi!

***Cryptoplectron erythrorhynchum.** The Painted Bush Quail.

In small parties in forest clearings under grass and stumps. Two males shot had their testes 3×2 mm. and wings 83 and 86 mm. The bright red beak is very noticeable as the bird flies across.

***Francolinus pictus pictus** (Jardine & Selby). The Painted Partridge.

A solitary bird was flushed off the road between Lamasinghi and Chintapalli at about 2,500′.

***Francolinus pondicerianus pondicerianus** (Gmelin). The Gray Partridge.

Waltair!

Turnix tanki tanki Blyth. The Large Yellow-legged Button Quail.

La Personne shot this bird at Sankrametta. Some sort of button quail was seen and heard drumming at Lamasinghi. A largish odd-sized pair of quail flushed in scrub on hill side was probably this species.

***Porzana pusilla pusilla** (Pallas). Baillon's Crake.

Single bird shot at Kondakarla on 24th December 1944.

***Gallinula chloropus indicus** Blyth. The Indian Moorhen.

Kondakarla 24th December 1944. Two shot and several seen.

***Fulica atra atra** Linnaeus. The Coot.

Common at Kondakarla. Three birds shot (2nd June) were all females with granular ovaries.

***Hydrophasianus chirurgus** (Scopoli). The Pheasant-tailed Jacana.

Common at Kondakarla (also in March in off plumage).

***Larus brunnicephalus** Jerdon. The Brown-headed Gull.

Small parties in Vizagapatam Harbour, Christmas 1944. Identified by the 'mirror' in the wings.

***Lobivanellus indicus indicus** (Boddaert). The Red-wattled Lapwing.

Waltair in March! Lamasinghi (McCann)!

***Tringa ochropus** (Linnaeus). The Green Sand-piper.

Christmas 1944 a few at Kondakarla!

Tringa hypoleucos Linnaeus. The Common Sand-piper.
Christmas 1944, a few seen at Kondakarla!

Tringa glareola (Linnaeus). Green Sand-piper.
Commonest wader at Kondakarla. Christmas 1944.

Scolopax rusticola Linnæus.

The *Gazetteer* states 'of the rarer game birds, the Woodcock has been seen around Padera'. Padera is in the hills, west of Sankrametta. I did not see a single snipe during Christmas—the soil is perhaps too sandy.

Pelecanus onocrotalus Linnaeus. The Roseate Pelican.
Recorded from Kondakarla by S. C. Law (*J.B.N.H.S.*, vol. 30, p. 483).

Pelecanus roseus Gmelin. The Gray or Spot-billed Pelican.
Male shot at Kondakarla had fed on fish 1" to 3" long.

Phalacrocorax niger (Vieillot). The Small Cormorant.
Several seen at Kondakarla 24th December 1944.

Anhinga melanogaster Pennant. The Snake Bird or Darter.
Kondakarla!

Egretta intermedia intermedia (Wagler). The Middle Egret.
Kondakarla and Waltair!

Egretta garzetta garzetta (Linnaeus). The Little Egret.
Kondakarla and Waltair!

Ardeola grayii (Sykes). The Pond Heron or Paddy Bird.
Waltair!

Phoenicopterus ruber roseus Pallas. The Flamingo.
S. C. Law noted flocks flying south at Vizagapatam in August (*J.B.N.H.S.*, vol. 30, p. 483).

Rhodonessa caryophyllacea (Latham). The Pink-headed Duck.
Old records (Game Birds, Hume & Marshall, iii, p. 175) from Kondakarla.

Nettapus coromandelianus coromandelianus (Gmelin). The Cotton Teal.
Several were shot at Kondakarla on 2nd June. The females had granular ovaries and the testes of the males measured 8×4 mm. A flapper with moulting quills was shot during Christmas.

Dendrocygna javanica (Horsfield). The Smaller Whistling Teal.
Kondakarla!

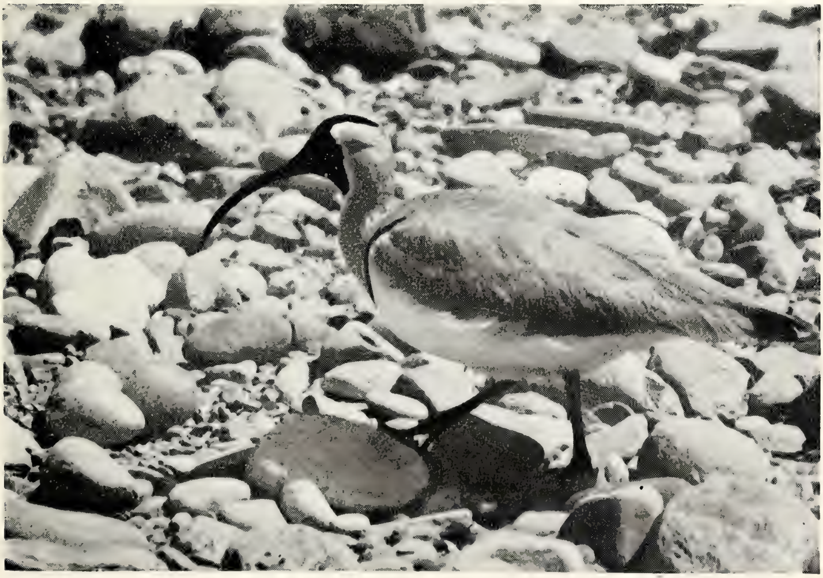
Anas poecilorhyncha poecilorhyncha Forster. The Indian Spot-billed Duck.
Mr. R. F. Stoney has shot it in the Vizagapatam District (*J.B.N.H.S.*, vol. 39, p. 460).

Chaulelasmus streperus (Linnaeus). The Gadwall.
Mr. R. F. Stoney has shot a few in the Vizagapatam District (*J.B.N.H.S.*, vol. 39, p. 460). 'One of the commonest duck in this area' (*Gazetteer* 1907, p. 23).

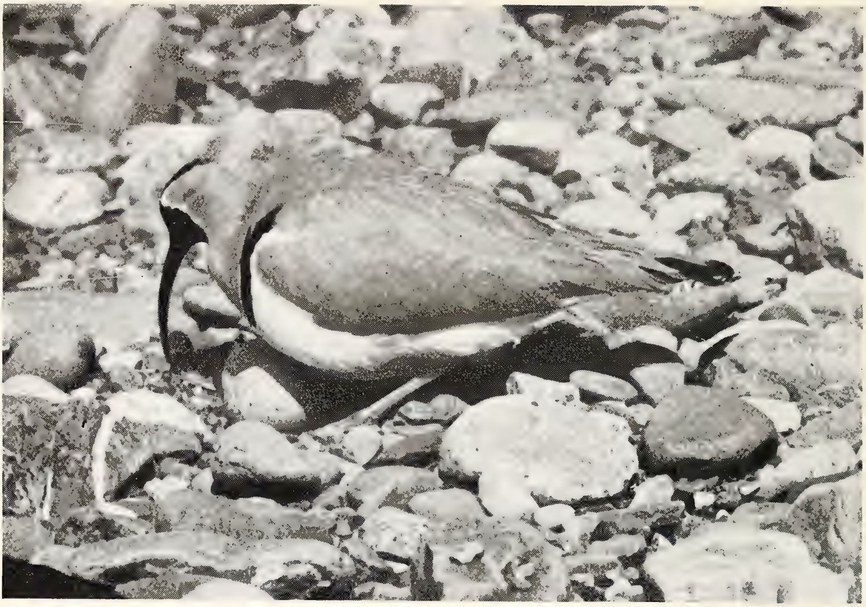
Casarca ferruginea (Vroeg). The Brahminy Duck.
Seen at Kondakarla during Christmas.

Dafila acuta (Linnaeus). The Pintail.
Wing of bird shot near Vizagapatam during Christmas examined.

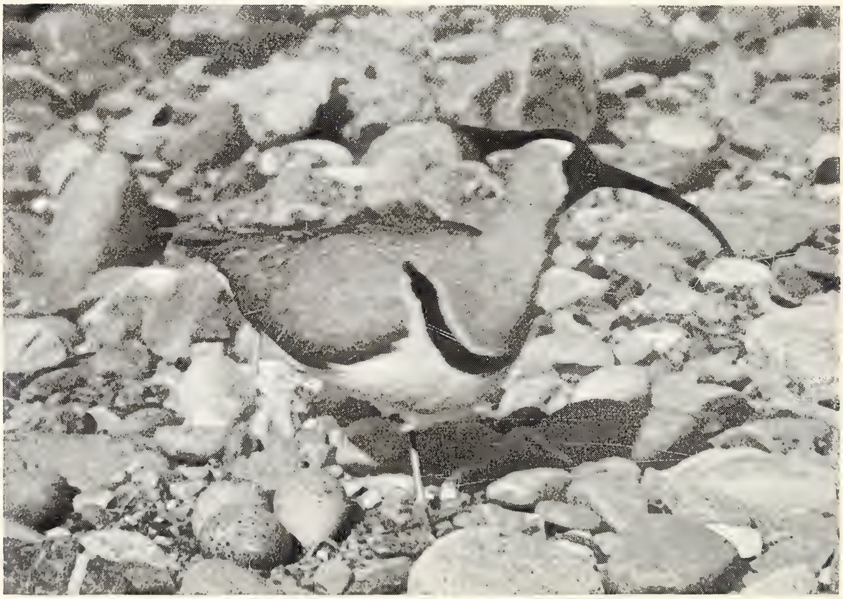
1. An early spring vista along a subsidiary valley in Kashmir —a favoured haunt of the Ibis-bill.



2. Alert and with measured tread, the Ibis-bill approaches the nest.



3. Settling down to brood.



4. Disturbed and about to creep away before taking to wing.

***Spatula clypeata** (Linnaeus). The Shovellor.

Seen at Kondakarla during Christmas.

Anas penelope (Linnaeus). The Wigeon.

Mr. R. F. Stoney shot only one in the Vizagapatam District over a period of about thirty years (*J.B.N.H.S.*, vol. 39, p. 462).

Netta rufina (Pallas). The Red-crested Pochard.

Mr. R. F. Stoney shot 12 in the Vizagapatam District in 1928-29. Christmas Kondakarla!

Aythya ferina ferina (Linnaeus). The Red-headed Pochard or Dun-bird.

Mr. R. F. Stoney shot two in Vizagapatam District in 1928-29. Christmas!

Aythya marila (Linnaeus). The Scaup.

Col. McMaster records seeing several birds of this species on marshes and salt lakes between Chicacola-Berhanipore (Hume and Marshall, iii, 271), but Whistler doubts the record.

Aythya fuligula (Linnaeus). The Tufted Pochard.

Mr. R. F. Stoney has shot it in the Vizagapatam District.

***Podiceps ruficollis capensis** Salvadori. The Little Grebe or Dabchick.

Common at Kondakarla and also seen from the train at Vizianagram. Three nests with c/3 each were seen at Kondakarla during Christmas. Curiously all were left uncovered.

PHOTOGRAPHING THE IBIS-BILL

(*Ibidorhyncha struthersii* Gould).

BY

LT.-COL. B. T. PHILLIPS, I.A. (Retd.).

(*with 2 plates*)

Ornithologists will readily appreciate the excitement of a keen observer and photographer on hearing that a rare bird, which had hitherto been believed to be one of the migrants passing through on their way to and from the far North, was actually breeding by one of the mountain streams in Kashmir.

It was indeed a red letter day when I received an invitation from a friend, who had known the Ibis-bill in many regions of the inner Himalayas, to bring out my equipment, stay at his fishing camp and try my hand at photographing this *rara avis*. As I was under the impression that I had already been successful in photographing every species that frequented the Kashmir torrents, I should have been highly sceptical about the possibility of adding another series of pictures to my collection, had not the description of the bird,—a wader, larger than the usual waders in these parts with a curiously curved long red bill—placed its identification beyond all possible doubt. The warning that the bird was extremely shy, and so rare in Kashmir that a considerable reward had been offered for a clutch of its eggs, and the consequent need for the greatest secrecy still further increased my enthusiasm. I lost no time in packing my home-made equipment and in setting out to avail myself of this gloriously unexpected opportunity.

One advantage of bird photography as a hobby is that, though it frequently involves considerable labour and pains, it is always exercised in delightful surroundings; and my pursuit of the Ibis-bill proved no exception. L's camp was pleasantly situated on a patch of green sward on the bank of a swiftly flowing torrent, which sparkled over the shingle and boulders, and was joined by a number of merry little babbling side streams. The surrounding hills were gleaming with every shade of verdant spring, and the more distant snow-capped peaks and mountains added to the splendour of the setting. What could I have wanted more? An ideal camp site, a congenial and enthusiastic companion, a *rara avis* awaiting me in the studio and the certainty of succulent trout 'all-alive-O' whenever my inner man craved for food. Nothing. It was with a pleasurable thrill of anticipation that I accompanied my host on a preliminary reconnaissance of the nesting site.

But 'there is many a slip 'twixt cup and lip'. So well did the nest with its clutch of eggs blend into its surroundings that we were unable to find it! Step by step, with the utmost precaution, we cast in every direction, to and fro, across the spit of shingle where the pair were known to be breeding, but not an egg could we find! We renewed our search and were on the point of abandoning it, and were actually giving vent to our feelings about marauding jackdaws when, with a sudden and painful kick on my advancing foot, my host just saved me from committing an irretrievable disaster. I had been within an ace of crushing a clutch of 3 eggs to smithereens. It is no exaggeration when I say that the joy of discovery combined with the narrowness of my escape gave me no mean thrill. To save time, and to eliminate the possibility of error on the morrow, we laid out three arrowheads of red stones pointing in the direction of the nest.

April is a rainy month in Kashmir or, at best, the weather is very unsettled and anything but ideal for photography; but the next day was bright and sunny and, the omens being propitious, my bearer—almost as great an enthusiast as myself—and I set out to the site in high spirits.

With infinite care we erected my camera, complete with its 12-inch telephoto lens, stand, and electric release, some fifteen feet from the nest and camouflaged the edifice to resemble a tamarisk bush. We then ran out the battery cable, taking great pains to ensure that we left no kinks in it, as this might cause a slight movement of the wire which would certainly attract the bird's attention and agitate it, giving it the impression that a snake had designs on its sanctuary. Any alteration in the landscape, in this case, the appearance of a new bush, never escapes a bird's notice but, after observing its stationary appearance, except for the fronds waving naturally in the breeze, he, or she, will soon take it for granted and pay it no further attention. On this occasion, owing to the exceptionally timid nature of the bird and the bare stretch of shingle surrounding the nest, I had to run out the full 150 yards of the cable to where my bearer could lie hidden in some bushes, press-button in hand, ready to release the shutter and make an exposure on a pre-arranged signal. I then took up a more elevated observation post on the bank of the stream from which, through my binoculars, I could see the directing arrows pointing to the nest, which was nothing more than a scrape in the stones and, though it was lined with small smooth pebbles, was perfectly invisible from the distance of a few feet. My ambush was now complete. I had not long to wait. In my younger, and big game shooting days, I have often trembled with excitement at the sight of an approaching feline, but the sensation was every bit as intense when, a movement in the distance attracting my attention, I raised my binoculars and saw that my harmless feathered quarry had arrived in the vicinity.

The bird, after alighting on the stones, made a dilatory approach towards the nest, though ever on the alert for unforeseen danger. The remarkably quick growth of the tamarisk bush did not escape its attention and, from the bobbing of its head, I gathered it was regarding it with considerable suspicion; but, soon coming to the conclusion that it was harmless, with a final quick little run, it reached the nest and settled down to brood.

It is said 'patience is a virtue'; but, it can also be a great trial. The rare Ibis-bill was posing to perfection in the studio but I have learnt by experience that it is a great mistake, if you want a series of exposures, to click the shutter too hastily. A bird remains in a state of alarm and intensely on the alert for some time after settling on its nest and, though outwardly at ease, it is still highly suspicious of the slightest change in the surroundings till the presence of the eggs and the undisturbed nest gradually lull it into a sense of security. Notwithstanding my anxiety about letting slip an opportunity that might never occur again I have trained myself to wait for at least a quarter of an hour before proceeding to take liberties.

It may be imagined that my home-made apparatus places me at a disadvantage when arguing the *pros* and *cons* connected with distant release *versus* hide methods of bird photography, as there is no means of resetting the shutter without returning to the camera for that purpose; but my bearer and I have evolved a technique of approach which rarely, if ever, seriously disturbs a sitting bird. I saunter casually towards him, and then we stroll together very leisurely in the direction of the nest, plucking a leaf here, examining a flower there, chatting together in low tones till the fake bush is reached, there one of us quickly resets the shutter and, if necessary, alters the exposure, this completed, we saunter off leisurely by circuitous routes to our respective observation posts. Our movements naturally arouse the bird's curiosity, but it soon becomes accustomed to them, and to induce it to accept them as a matter of harmless routine I make my exposures at not less than half hour intervals, notwithstanding the tedium of motionless waiting.

Not to trouble the reader with further details of my methods, in two days I made twenty successful exposures, eight in black and white and a dozen in colour, three of which illustrate this article, the fourth illustration shows the valley chosen as the bird's habitat and breeding ground, the exact situation of which, for obvious reasons, I refrain from mentioning.

Notwithstanding complete lack of cover in the close vicinity of the nest, birds brooding in the open are easier to photograph than those which conceal their nests in bushes, trees, marsh or water for their suspicions are far more readily allayed as little, if any, re-adjustment of the immediate foreground is necessary. To photograph a bird nesting in a bush is a far more tricky problem, as leaves and twigs have to be removed to expose the nest to the inquisitive lens of the camera, and to admit sufficient light to permit the making of an exposure. But these difficulties can be overcome with patience and care. I never snap off any obstructions but tie them back with string, releasing them to resume their former positions again at the end of the day's work, thus protecting the nest from marauders and quelling any continued alarm or suspicion that might cause the bird to desert its nest. Under adverse lighting conditions, I have even been successful in tempting a bird to leave its nest and pose for me on a temporary twig placed conveniently within the focused area of the camera.

Whenever possible I take a series of pictures to illustrate the individual habits and peculiarities of each bird and have thus obtained considerable first hand evidence of many of Nature's secrets. To those who deprecate the art of bird photography, and designate it as a cruel 'sport' which leads to unnecessary destruction by causing birds to desert their nests, I reply, that if it is undertaken with due care and consideration by a lover of birds, no harmful results need ensue. I have successfully photographed over a hundred different species on open shingle, in bushes, trees, marsh or open water and, to the best of my knowledge, not a single clutch of eggs has failed to hatch out as a result of my interest and activities in this fascinating branch of natural science.

To return to the Ibis-bill. This clutch hatched out in due course and the young birds went their way in the natural scheme of things. On a later occasion I made the further acquaintance of this rare bird in Kashmir and now know of three nesting sites in the boulder strewn beds of its mountain streams, which held clutches of 3, 4 and 5 eggs respectively. A few words about its habits as the result of actual observation may add a little interest.

The Ibis-bill is readily recognisable by its three inch long, deep-red, curved bill and its overall length of fifteen inches. Its white under plumage beneath a broad black gorget, so conspicuous in flight, all but disappears the moment the bird alights to become transformed into a bluish-grey object tinged with rufous, conforming exactly with the general tone of its shingle haunts. The nesting site is usually entirely devoid of cover and is placed on the crest of a ridge of shingle dividing the main stream of a torrent from its subsidiary overflows, thereby rendering it safe from flooding by the daily rise of the water level as the snows melt in the sun. As I mentioned before, the nest is a mere scrape in the ground, though it is neatly lined with smooth pebbles by the birds themselves. The colour of the eggs—3 or 4 to a clutch—so resembles the shingle on which they are laid, that careful approach is essential if a disaster, as nearly caused by myself, is to be avoided.

After flying towards its brooding area, the Ibis-bill alights on the shingle some twenty or thirty yards from the actual site of its nest, usually amongst a patch of stunted tamarisk bushes whence it emerges, apparently unsuspectingly, into the open, pecking a morsel here, turning over a stone there but none the less ever on the alert, turning its inquisitive eyes with a little bob of its head in a careful scrutiny of its surroundings. It shows no sign of haste till within a yard or two of its nest when, presumably spurred on by the sight of the eggs, it breaks into a quick run, bends over them, and possibly turns them over before sitting. Woe betide the impatient photographer unable to refrain from clicking his shutter before it has finally settled down!

Once brooding, the Ibis-bill, in contrast to most other sitting birds, remains remarkably still on the nest. There is no plucking at a leaf or a blade of grass or adjusting an uncomfortable pebble; but, with head lowered into its neck and its curved red bill lying along the contour of its breast, it transforms itself into bluish-grey piece of rock; one of Nature's perfect examples of camouflage. Before long another bird will be seen following the course of the stream, leisurely flapping its rounded wings after the manner of a Peewit, though every now and again, as it twists and rises to avoid something suspicious on the ground, its quickening wing beats give a more jerky appearance to its flight. This will be the sitting Ibis-bill's mate coming to keep guard over their precious nest. On alighting he, or she, will remain perfectly still part and parcel, as it were, of the stones of the river bed but ready at an instant's notice to rise with a quick turn of speed to give aerial combat to such arch marauders as the kites and crows.

The Ibis-bill shares the common traits of most ground nesting birds in displaying a very alert all-round watchfulness, not the slightest flicker escapes attention; also, I assert, a marked intelligence,—a behaviour discriminating between the possible dangers that arise from the presence of human beings, and that of animals roaming about their breeding area. In the former case, a direct approach, even though the individual be still at a distance, is sufficient to cause the bird to leave its nest and literally creep away from it, before taking to wing in the distance; on the other hand, should the approach be circuitous, the bird will sit tight in the hope that its stillness and feathering, will escape attention, until it is on the verge of being trodden down, when it will flutter off, feigning injury; none of this subtility is shown by the bird when grazing horses, sheep or cattle, which cause much destruction to open ground nests, endanger their very lives, for then it simply slinks away just out of reach of the murderous hoof and returns again to its nest, quite unperturbed, immediately the danger has passed.

In conclusion, I note that it is stated in the *Fauna of British India* (Birds) that the adult breeding Ibis-bill has blood red feet and legs but, on both the occasions on which I have seen them at their nests, their feet were a livid and greenish grey colour, the colour assigned to non-breeders. Though the rule laid down may not be infallible, yet it is possible that I had observed the same pair breeding again, nesting on a site only seventy yards removed from that of a former nest used four years previously, perhaps this is an example of the unerring instinct shown by migrating birds in their return year-in, year-out, to their same chosen breeding haunts.

TROUT OF TRAVANCORE.

BY

W. S. S. MACKAY.

WITH A FOREWORD

BY

H. A. RAGG.

(*with 2 plates*)

'Of recreation there is none
So free as fishing is alone;
All other pastimes do no less
Than mind and body both possess;
My hand alone my work can do,
So I can fish and study too.'

The Angler's Song, 1653.

FOREWORD

It is a great pleasure for me to write a foreword to Mr. Mackay's *Trout of Travancore* as I have been able to watch the results of various attempts to establish trout in the waters of the High Range over a period of thirty odd years. It was not until Mr. Mackay built the Rajamallay hatchery and later took over the stocking of the waters that success was attained.

The chapters describing the management of the hatchery and the disposal of the fry make very interesting and instructive reading.

The three outstanding factors which have been responsible for turning failure into success are, firstly, the very liberal help which has been given to the High Range Angling Association by the Directors of the Kanan Devan Hills Produce Company Limited, without which it would have been impossible to carry on with the work, secondly, to Mr. Francis for his keenness and foresight in his 'Eruvikulam Policy' as it was very largely due to this scheme that failure was averted, and lastly to Mr. Mackay for his untiring energy, and keenness and for his excellent work in 'fair weather and foul'.

It is a great pleasure to anglers to wander up these lovely streams and to see the number and the size of the fish and to realise the money and energy expended have reaped their just reward.

H. A. RAGG

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INTRODUCTION

The Kanan Devan or the HIGH RANGE forms part of the system of hills and passes known all over the world as the Western Ghats, stretching from Poona to Cape Comorin. Although much of the country has now been opened up into tea, it has lost very little of its original grandeur, the highest land being quite unchanged.

Messrs. James Finlay & Company of Glasgow were granted a second concession of 200 square miles some 50 years ago, and amongst other beneficial innovations the stocking of the streams with trout, received their attention.

The first experiments were carried out as far back as 1909 but until the year 1939 no great success was achieved.

The country round which all recent experiments have been conducted lies in close proximity to Aneimudi, the highest peak south of the Himalayas, 8,841 feet above sea level. It was in the streams of Hamilton's Plateau lying north of Aneimudi that Rainbows were first found to be breeding, and it is on the slopes of this mountain itself that the present hatchery is situated.

It was suggested to us that we should write the story of trout culture in this part of Travancore before the early records available were finally lost in the passages of time. Indeed the work was started, and part of it appeared in the *Field* of March 1940. The final attempt to establish trout was inaugurated in 1937, and by 1944 success had at last been achieved.

Permanent success, however, still remains to be assured and the need for knowledge is acute. Though the black years are over, it is necessary to turn to the future, planning for several years ahead, and much study in relation to local conditions is required. It is in this way only that the angler can be satisfied and big baskets and a reasonable weight average maintained, We hope the following pages will serve two important purposes, which are:—

1. To record our varying fortunes from the beginning, in such a manner that past mistakes cannot be repeated.

2. To stimulate interest and to educate the angling public to the magnitude of the tasks before them.

Without the co-operation of all anglers in the High Range these tasks would be impossible, but it is in the full assurance of that co-operation we submit this work.

We have to acknowledge with grateful thanks reference to Mr. Philip Fowke's work 'Trout Culture in Ceylon', and also to his many interesting and instructive letters. Also to Mr. W. H. Armistead's 'Trout Waters' and 'Practical's 'Fish Farming for Pleasure and Profit'.

I.—How Trout Breed.

In ancient days in the British Isles, nature looked after the stocking of the rivers and lochs unaided. Indeed until the present century the proprietors of fishing waters had little or nothing to worry about, as there were no tar Macadam roads, cars making access to all water an easy matter, or new fangled methods and patent instruments, for taking fish. In accordance with individual conditions nature allows somewhere between 2% and 7% of the number of eggs laid by a fish in fresh water to hatch and mature, and in the good old days this was sufficient to stabilise the trout population at a reasonable level. But with the march of time and the steady decrease of stock, due to excessive fishing, netting, and poison discharged from factories, nature could no longer tackle the problem alone. In 1856 the difficulty was overcome by a Russian named Vrasski, but before we relate this fascinating story, it is necessary for us to consider how trout breed.

Trout breed during the coldest period of the year, and when they come into season they make for the upper reaches of the streams, or the burns draining into lochs, where cold clear running water is generally to be found, and where there are sandy banks and gravel beds. In company with several male fish, each struggling for her possession, the female or hen fish as she is called, makes her way up stream until she finds a suitable place for her nursery which is generally at the tail of a shallow run or pool. On the hen fish falls the work of constructing the nest or redd, and this she does by pressing herself against the stones and gravel, and moving a foot or so upstream, she excavates a hollow with powerful sweeps of her tail.

When the redd is complete the hen fish makes a new movement. Once more she passes up the redd turning from side to side. This time she is laying, and the male or cock fish following closely behind exhibits intense excitement, and drives away any smaller fish that may be in the vicinity. With each flash of her side the female sends out a single stream of eggs, which are heavy and sticky. Having laid a certain number she immediately passes to one side, to be at once supplanted by the male who passes over the eggs shedding his milt as he goes. The fish then move off to another redd leaving the eggs to the mercies of their very numerous enemies. Several spawnings occur in a season before the spawners finally return to deeper water. A hen fish lays between 700 and 800 eggs for each pound of her weight, and in breeding no actual contact takes place between the sexes.

Now man had for many years studied and observed these operations, so at last when the necessity for experiments became essential, he commenced to breed trout by catching the wild spawners as they came to the shallow pools in the head waters, and stripping the eggs and milt into a basin of water, placed them in running water to hatch. A modicum of success was achieved, but an old gentleman called Seth Green, an American, began to produce astounding results. He was a dour old man and always kept his mouth tightly shut, so that when he departed this life his secrets went with him.

Until this time the work had been in the hands of practical men, gamekeepers no doubt, and men well acquainted with the ways of the woods and rivers, but now Vrasski, a Russian naturalist and scientist, began to make experiments using the microscope with which to examine the eggs and milt. He found that the eggs on stripping were sticky and adhesive, which is a provision of nature to guard against them being washed from the redds by a sudden increase in the flow of the water. He found the ova to be intensely absorbent, and that from the time they leave the fish they absorb water quickly until saturation point is reached.

He found the sperm of the male fish to be intensely active in water, but this activity soon ceased, the sperm becoming lifeless or in other words drowned. It was here that the secret of Seth Green was revealed, and taking a *dry* basin he stripped the eggs and milt into it discovering that now he could, without difficulty, obtain success, the milt coming into contact with all the eggs before losing its fertility. Later in this work the stripping of trout is dealt with in detail.

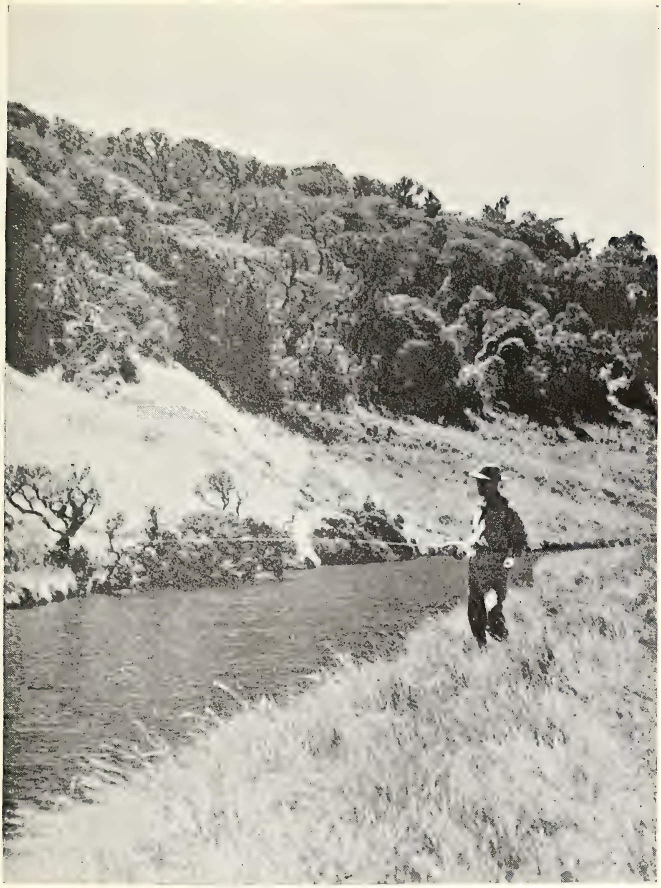
Despite the fact that Vrasski at once made his discovery known to the world at large, it was nearly a quarter of a century before it was accepted by the experts who were hatching trout in other countries. At last however the DRY METHOD of stripping ova was acknowledged, and in the Russian's honour it is popularly called the *Vrasski method* to-day.

II.—THE FIRST EXPERIMENT WITH BROWN TROUT.

Transportation of Ova from Scotland.—The whole question of breeding trout is governed by temperature. In very cold countries eggs may lie in the hatching troughs for a hundred days. In the warmer climate of the High Range of Travancore the hatching period is reduced to 28 or 29 days. At an average temperature of 50°F. ova will hatch in 50 days, with a decrease of five days in this period, for every degree rise in the temperature. With the modern types of cold storage, it is possible to transport eyed or fertile ova, to almost any part of the world. The ova is generally packed in moss and placed on trays, which are fitted into a square wooden box for local transport in India. The temperature is kept constant by the application of ice, but during transport by sea the box should have facilities for proper examination to allow for the removal of dead eggs, which are easily discerned as they turn white and show up well against the delicate pink of the healthy ones.

In 1909 four planters M. C. Koechlin, John Carless, 'Daisy' Bell and 'George' Howlett were discussing trout fishing in the bar of the High Range Club, as at that time great success was being recorded from Ceylon, and in the Nilgiris experiments had been going on since 1863. In 1906 the Nilgiri Game Association were fortunate enough to secure the services of an experienced pisciculturist, the late Mr. H. C. Wilson, who had shown that experiments with Scottish Brown Trout (salmo fario) were unsuccessful, because of the insuperable difficulty of the females being ready to spawn before the males were in season. He pinned his faith to the Rainbow trout (salmo shasta) or the Steelhead (salmo irideus) and it is believed imported ova from Insbruck, Austria, out of which nine trout survived. Later from New Zealand ova was obtained from which considerable success was achieved. A hatchery on up to date lines was constructed at Avalanche, where steady progress has been made from then, until the present day.

In the light of these successes the planters argued that there was no obstacle to successful operations of a similar character being carried out in Travancore, and they finally approached Mr. P. R. Buchannan, the General Manager of the Kanan Devan Hills Produce Company, for advice. Mr. Buchannan was a man of foresight and sagacity, and innovations of all kinds received his careful attention. It appears, however, that the experiences of the tyros in the Nilgiri Hills had not at that time been fully understood, for arrangements were made to import the eyed ova of Brown trout from the hatchery at Howieton in Stirlingshire. The first consignment was sent direct to Bombay where it was met by Philip Gouldsbury and successfully brought to the High Range. On another occasion a box containing 10,000 ova was duly delivered by the Howieton people into the charge of M. C. Koechlin returning from leave on board a ship sailing from Liverpool. No details are available of this particular voyage or of the difficulties experienced if any, but it is known that the operation was successful. In those days transport difficulties were considerable, so when the chest of ova arrived at Colombo it had to be transhipped to a coasting vessel bound for Tuticorin. In the absence of cold storage facilities aboard the coaster large supplies of ice had to be arranged for. At Tuticorin ice was required for the train journey to Kodaikanal Road Station, and lastly for the 75 miles drive by bullock cart to the bottom of the riding ghat, where the chest was taken over and carried by head load to Top Station, an elevation 6,200′ above sea level. On one such expedition, the last of its kind, which was undertaken by George Strachan in 1913, the ice ran out uncomfortably far from his destination, but with good fortune, and by hurrying on the coolies, he succeeded in reaching the High Range safely, and a splendid success was achieved.



(1) Major J. R. S. Mackay at Eruvikulam where the first Brown Trout were caught about 1910.

(2) Upper Eruvikulam with Aneimudi in the background.

(4) The result of careful stocking.

(3) Turner's Valley.

In the interim period between the ordering of the first ova and its arrival in the High Range a small hatchery was constructed at Chundavurrai by John Carless who with the help of H. A. Ragg supervised the work in connection with the hatching of the ova.

The First Hatchery.—This hatchery was situated about a mile from the Chundavurrai factory. It was a simple enough affair, the water being led in from an open channel broken at several points by silt traps, to a distributing trough, from which two hatching troughs were supplied. The whole construction was of timber and the final filtration of the water was accomplished by fitting in wooden frames covered with towelling at the head of the troughs. In theory the system was adequate, but in practice somewhat unsatisfactory. All day and throughout most of the night a reliable overseer, which generally turned out to be one of the European Managers of a neighbouring Estate, was compelled to be in attendance, constantly changing the filters which had become clogged with dirt, and keeping an eye on the flow of the water. History does not record all the difficulties they overcame, but it is a matter of great credit to them that they succeeded in hatching a very reasonable percentage of the ova they had imported all the way from Scotland.

Between 1909 and 1914 at least 25,000 eggs were imported, and about 10,000 fine little trout were hatched out at Chundavurrai. When all the difficulties of transport in those days are considered, this percentage must be looked upon as remarkable. The work was undertaken without the aid of any informative literature regarding trout culture in the East such as we have to-day, or the help of such experienced men as would be readily available at home.

Early Stocking.—The trout bred at Chundavurrai were liberated in the Kundaly stream above where the new dam for the Power Scheme is now being constructed. These trout made their way down stream, but alas many of them fell into the hands of poachers who set nets and night lines in the vicinity of Madupatty Estate. Some were also liberated at Kanniamallay and Guderale and J. M. Bridgman and E. H. Francis stocked the Othaparai stream, but few of these fish were seen again. Trout were taken to the wilds of Hamilton's Plateau and were liberated in the Eruvikulam river by A. W. John and a fellow planter, and these trout did exceedingly well. As far as we know no natural breeding of Brown Trout took place in this or any other High Range water.

The records of trout caught are unavailable. It is known that several magnificent fish were taken at Eruvikulam by 'Clan' Fraser and that a trout weighing 3½ lbs. of which there is a cast in the High Range Club, was caught on a worm near Periavurrai by M. C. Koechlin. The honour of catching the first Brown Trout however probably fell to Henry Gribble Turner, and this is how it occurred.

H. G. Turner's name is closely associated with the discovery of the Kanan Devan Hills, or the High Range, which he first came upon at the end of a lengthy 'shikar' expedition. He and his half brother, A. W. Turner, later formed a Company styled the North Travancore Agricultural and Planting Society, to whom a concession of 200 square miles was given 'and to their heirs and successors for ever'. Messrs. James Finlay and Company took over this Planting Company in the year 1896 and formed the Kanan Devan Hills Produce Company Limited. The land consists of high grassy peaks and plateaux, and the valleys which break up the country from end to end, were clothed with dense forest. Most of these valleys have now been opened up into tea, but the higher land remains much as it was a thousand years ago. H. G. Turner, who was a servant of the Government of Madras, was on the eve of retirement when he experienced a desire to revisit, for the last time, the hills he loved so much. In company with an old friend, 'Toby' Martin, another pioneer of the District, who was at that time in charge of Labour Recruiting at Bangalore, he camped out in the wild country of Hamilton's Plateau, in the vicinity of Aneimudi. One evening as they sat on a ridge above the head waters of the Eruvikulam river, on the look-out for a herd of Bison, they were astonished to see through their glasses unmistakable rings, apparently made by trout rising, in the still part of the river. They had no idea that any trout had been put into this river, and it was only then that they understood from the hillmen with them, that trout stocking operations had taken place the previous year.

The frequent and determined rises must have been altogether too much for these old warriors, for they at once proceeded to cut suitable lengths of cane from the forest with which to make a rod. The hook they fashioned from an old safety pin, and then all the lengths of string that could be collected from amongst their camp kit were joined together, a few grass hoppers were captured, and there they were ready for an experiment in dapping.

There was a high wind ruffling the water when they reached the bank, and every now and then, particularly in the vicinity of the wild Rhododendron bushes that overhang the banks, there would be the 'plop' of a considerable trout. Gathering a length of line in his hand Turner gently released the baited hook on the water, the breeze taking it down stream and gradually straightening out the line. Anxiously they watched the 'hopper' float past a bush. Then with a swirl and a suck the bait was drawn under the surface and he was fast into a splendid fish. Fortunately he must have been able to clear the bush and play his fish from the open bank beyond, for it was duly landed and weighed over the pound, a perfect speckled beauty of the variety known as *Salmo fario*, the Brown Trout. Several trout were taken in this manner and thus 'H. G.'s' last visit to these hills must have been all the more memorable for him.

The first Great War which broke out shortly after the last attempt at stocking foredoomed further experiments, but it appears clear that the whole project was now being looked upon as a failure and that the Company were unwilling to continue with it. We find no further references to fish and fishing until the year 1932 when A. W. John of Chittavurrai obtained permission from the Company to undertake experiments on his own account.

III.—RAINBOW TROUT.

The so-called Rainbow Trout of the Nilgiri Hills and Ceylon varies in appearance and habits. Rainbow Trout were first introduced to the British Isles about the year 1900 and were at once hailed with great enthusiasm in angling circles. A few voices were raised in warning, but the success of the fish itself from the sporting point of view silenced all further argument. The Rainbow proved to be a keen feeder, and of extraordinary rapid growth where feed was plentiful, a free riser and game, but with a tendency to stop rising as its weight increased. In the larger fish cannibalistic and migratory tendencies were pronounced.

We have often been asked what happens to our trout in the lochs of the High Range? Let us study the question in the light of experience at home and abroad.

First it must be understood that the Rainbow placed in the same water as his cousin *fario,* will develop at twice *fario's* rate in size and weight. The strong migratory instinct may be partly explained by the fact that, having culled the cream of the feeding from one part of the water in a short space of time, as these voracious fish can do, they move off to another part of stream in search of further well-stocked larders. But what happens to trout placed in a loch or an artificial lake from which there is no outlet? The answer may be found in the following experiences.

A certain lake in a mountainous part of the British Isles, which contained only a few wary char, was stocked with a thousand yearling Rainbows. The lake did not rise much, and as the outlet was small it was easily screened. During the first year the trout were seen rising freely and the general opinion was that though these trout had grown, they were not yet takable. The following June exactly 14 months after they had been liberated, the owner of the lake went down to see if he could land a fish or two, so that he might know how they were getting on. He had no idea in his mind that they would be ready for the basket. There was a fine ripple running over the loch when he arrived, and shifting cloud in the sky, and he soon perceived a rise not far away. At the very first cast he rose and hooked what at once appeared to be a heavy fish. The fish played well for several minutes breaking the water like a sea trout and ripping off many yards of line so that the reel screamed as if a salmon had been hooked in heavy water. When the fish was finally netted it proved to weigh no less than 2 lbs. and within an hour five had been caught the biggest being just under 3 lbs. The news of this great catch travelled far and wide and the experiment was hailed as a wonderful success. Towards the end of the season however the fishing fell off and the following year only a few trout were taken. What had happened? The screen was intact, the loch had never overflowed, and there was no possibility of the fish having departed upstream. They had simply taken to bottom feeding, and the deeper water.

In another instance at home an artificial lake with a bottom outlet, and containing no fish, was stocked. The water was surrounded with trees, and as it was almost stagnant it was deemed advisable to turn in only a few trout. These were never seen again for a year and it was thought that they had died. The water was therefore run off and there were the fish, almost the entire number, great fat lazy fellows some of 4 pounds, and only two-year old! These experiences bear a strong resemblance to our own trials at Chittavurrai, Loch Finlay and Devicolam, of which we shall now hear more.

A. W. John's Experiments.—In 1932 Mr. John first made a number of small artificial lakes at Chittavurrai, an estate lying on the north-east edge of the Company's concession overlooking the plains of Madura and at an elevation of 6,154′. He had taken advice, sound enough in theory, but incorrect in so far as his particular conditions were concerned. He hoped that his trout might thrive, and even breed in the feeder streams leading into his lakes, but in this he was disappointed. Yearling fry, fingerlings, were brought in fish carriers by lorry from the hatchery at Avalanche on several occasions. Supplies of ice were arranged at various points such as Coimbatore, Pollachi and Udamalpet, and the journey was undertaken at night. It was an arduous task demanding considerable endurance. The latter part of this journey up the narrow winding ghat road to the hills was generally undertaken as dawn began to break, and it was with relief that the cold air of the hills was felt and the back of the journey broken.

Mr. John at first transported a few hundred trout successfully. For 18 months he watched these trout rising freely, and then he allowed a few friends to fish the water. At the first outing five fish weighing 10½ lbs. were caught and throughout the season fish ranging from 2 to 4 lbs. were taken. The second year a fish of 5½ lbs. was caught but thereafter nothing. The lakes were stocked again with similar experiences but the big fish disappeared altogether. These lakes which were, in actual fact, acting as large silt traps, contained, latterly, many feet of thick black mud at the bottom. That the bigger fish died, many of them spawnbound and that they buried themselves in the mud would be a likely explanation for their disappearance.

In spite of the fact that this undertaking had been a failure, Mr. John had stimulated interest again, and our successes of to-day are very largely due to his keenness and determination.

A small Angling Association was now formed which was backed and largely financed by Mr. J. S. B. Wallace, General Manager of the Kanan Devan Hills Company, and the Association set to work and built the second hatchery at Arivikad.

IV.—The First Success.

The second hatchery was built and managed by Alasdair Steven but it was dogged by bad luck from the start. The choice of a site was to some extent that of an expert, and while conditions at the time of choosing it seemed suitable enough, it soon transpired that there were many disadvantages, the principle ones being rapid fluctuations in temperature and a water supply subject to muddy spates from the clearings of a neighbouring Estate. The hatching troughs were constructed of wood, later lined with galvanised metal and afterwards concrete. The filters were of cloth, and worked efficiently. Several importations of eyed ova from the Nilgiri Hills failed, the small fish or alevins of which we shall hear more anon, hatching out almost at once in the apparently too warm water, and, turning up their little tails, dying by the hundred. Some success was achieved from stock fish brought over from the Nilgiris and developed in ponds at Arivikad.

It was at this period that the general atmosphere round angling circles in the High Range became one of despair, and backing fell off almost entirely. The present General Manager of the Kanan Devan Hills Produce Company, Mr. E. H. Francis, was elected Chairman of the Association now consisting of 11 members, and he inaugurated a new idea, called 'The Eruvikulam Policy' and we shall presently hear how from this last despairing attempt, the success of the trout of Travancore, in 1943 became a confirmed and established fact.

While the experiments at Chittavurrai were going on, the loch at Devicolam and Loch Finlay had been stocked through funds raised from private subscriptions from the planters. At Devicolam, which is to some extent a natural loch, but screened and dammed to provide water power for Periakanal Estate, great sport was obtained, but the experiences here were in line with the first of the two home experiments already described. At Loch Finlay one good years' sport was obtained, but here again conditions were similar to those of the second home experiment. These fishing waters however provided sport close to the centre of the district, and so long as the possibility of catching a trout existed there, a few members of the planting community retained interest in the project. Mr. Francis, backed by the Directors of the Company, decided to review the whole position once again, and briefly the conclusions arrived at were these. No natural breeding of Rainbow trout could be expected at an elevation under 6,000'. Artificial lakes and ponds were quite unsuitable for these fish, as the big fish disappeared within the first year or two and many of these probably died spawn-bound. It was thought probable that fish died on reaching an age of approximately 5 years, but information on this point was still being sought. The hatchery site had been unhappily chosen and must be considered a dead loss.

On the credit side, we could turn our eyes to the highlands of Hamilton's Plateau where the Eruvikulam River rises, and there, we were confident, trout would thrive and multiply. Beyond Hamilton's Plateau further magnificent water at Puar and Kalar was clearly indicated on the map, while at Rajamallay Estate a splendid river drains out to the west. The Loch at Devicolam had already proved sufficiently successful to be worth restocking from time to time, and it had always been a great attraction for the residents in and around the town of Munnar.

At the hatchery we had some two hundred fry, and a few yearling trout, which had been earmarked for Eruvikulam. In spite of some opposition, the Committee decided to move these fry during the heavy monsoon of 1937 to Hamilton's Plateau, and liberate them in the headwaters of the Eruvikulam River. At that time there were no roads across the plateau, the last Estate path ending at the edge of the Upper Vagavurrai Tea Estate, below the 'Knife Back' ridge. From Arivikad the trout were transported by lorry in earthenware pots, and from the Upper Vagavurrai Bungalow by head-load. The expedition, in the height of a heavy monsoon burst, was no mean undertaking, but the fish travelled well, and the porters put up a very fine display of endurance. The expedition was well supplied with rum which put heart into the men for the homeward journey in the evening. Not a single fish was lost during the transport and as the temperature was steadily dropping in the carriers during the whole journey they were liberated almost at once. It was a wonderful sight to see the little chaps wriggle off so fit and well, and to feel that, at all events, the first stocking of this magnificent water had been accomplished. In 1938 Mr. Francis presented 500 fry to the Association for the purpose of further stocking at Eruvikulam. These were brought through from the Nilgiris by one of the hatchery attendants, but, alas, his transport was not carried out with sufficient care. As a result of this a considerable number were lost *en route*, but again head-loads were successfully taken across the plateau and 301 fry were liberated.

In completing our stocking operations on this occasion and returning to the site of our camp, on the spot where the Company has now erected one of their Boundary Inspection Huts, somebody made the suggestion that a cast be made to see if one of the trout of the previous year's stocking could be caught and examined. A rod was put up by the writer, who made a cast with a small 'Watson's Fancy', at the head of the run into the pool now known as 'The General's Pool'. A trout rose at once and was missed but at the second cast it rose again and was hooked. It was a heavy trout but without a great deal of fight and it was soon brought to the bank. Astonished eyes beheld a monster weighing 4½ lbs. a cock Rainbow in perfect condition. This trout, one of 160 liberated the previous year, had put on at least 4¼ lbs. in 16 months! This is a typical illustration of what can happen when rainbow trout are liberated in virgin water so full of natural food as was Eruvikulam in those days. The following year Lieut.-General E. F. Norton, C.B., D.S.O., M.C., of Everest fame, his wife and the writer, caught six trout weighing 20 lbs., no less, while Mr. E. H. Francis and the writer have between them caught four or five weighing just under 5 lbs.

Those of you who have read that delightful book by H. R. Jukes, 'Loved River', will remember how they succeeded in hatching out trout in an old perforated steel trunk filled with sand and gravel. From this idea in a slightly elaborated form, experiments were now undertaken. The experiments, which were almost solely governed by the generosity of a few keen fishermen and the Company, had to be conducted upon an economical basis, and in order to lessen transport costs ova was purchased instead of fry. Ova boxes were made approximately the shape of a standard steel trunk, but constructed with a frame work of angle iron to which was fitted very fine perforated zinc sheeting. These boxes were partly filled with gravel and placed at the tail of a run in the main river where the current is slow. The first ova was bought from the Nilgiris, but this experiment was a complete failure owing to the hatching boxes having been placed in a side stream in the bed of a swamp where dirty water was at once stirred up with the lightest shower of rain. At Christmas 1940, however, a fairly successful experiment was carried out near 'Mackenzie's Old Camp' site and a more successful one in the main river itself, with ova from Ceylon. Some five or six thousand trout were hatched out and liberated, but what was even better, *definite proof* was established that our fish were breeding naturally and several families of young fry were discovered in the headwaters.

It was stated earlier that the question of breeding trout was governed by temperature and that the normal method of sending eyed ova from one place to another is by packing them in moss on trays fitted into a wooden box filled with ice. All that is necessary to do when transporting the box is to make a periodical inspection and fill up with ice, and as most journeys of this kind in South India only necessitate a matter of a few days, the question of picking out dead eggs does not arise. When the ova chest arrives at its destination it is immediately opened and the ice from the top tray removed. A thermometer is then placed in the box which is closed again. The temperature of the water into which it is intended to place the ova is now carefully checked, and after 15 minutes the thermometer in the box is examined. For the sake of argument we will assume that the water temperature reads 56°F. and the temperature inside the ova chest 40°, a difference of 16°F. It is necessary to bring the temperature of the ova chest slowly up to that of the water, and this operation must be carried out with great care and *without hurry or excitement* which are fatal in dealing with any item of hatchery work. A watering can with a fine rose should be kept handy, and periodically a little water poured over the box and on to the top tray. This water gradually seeps down from tray to tray over the moss, and by degrees the temperature will be observed mounting. Sometimes if the attendant is competing against a rising temperature in the stream or hatchery, it may take him up to 12 hours to complete this work, but the rule must always be THE SLOWER THE BETTER, because sudden acceleration, or a degree or two difference in temperature when the eggs are planted, may well spell death to thousands of them. When the temperature on the top tray has come up to the required level then work can proceed more quickly. Removing the first tray the moss is lightly picked off, and the eggs, inside a piece of fine cloth or muslin, disclosed. The cloth is carefully lifted and placed in a basin of clean water, and the eggs liberated. Odd bits of dirt and moss will float to the top and these should be skimmed off. The eggs which are a delicate shade of pink have a black spot. This is the eye of the fish, and is the indication that the eggs are ripe. From the basin the eggs are poured gently into the hatching box and distributed over the gravel as evenly as possible. The eggs have a tendency to adhere together and lie in heaps in all little depressions in the gravel. When all the eggs have been placed in the box, the lid is closed and a grass covering placed on top to obscure light. The box should be in complete darkness, The fish farmer should, from now on, constantly be on his knees in prayer, for, should a sudden spate come down and flood the boxes with dirty water the eggs will die. Dirty water is death to the eggs, but apart from that the sudden rush of heavy water would tend to wash them against the bottom of the box and so damage them.

This system of hatching trout by the box method was further elaborated and carried out with success in 1941 at Rajamallay, in the river close to where the hatchery is situated to-day. The fry from this hatch were taken to Devicolam and Chittavurrai and liberated there. The further purchase of 5,000 ova was made from Ceylon and these eggs were flown over to Trichinopoly and from there brought up by car. Two planters went down to Trichinopoly to meet the plane. All went well until leaving for home, when the car broke down. It was found that the car could not be repaired that day, and so while one of the planters stayed in charge the other proceeded by train with the ova chest. But further troubles were still in store, and at Dindigul the train to Udamalpet, the station nearest to the High Range, was missed. After much difficulty a car was hired to go to Udamalpet whither another private car had been summoned by telegram. The eggs arrived a day late with just sufficient ice in hand. About 2,000 fry were finally hatched out by the River Box Method, and taking everything into consideration this appeared, at the time, quite a satisfactory result.

The position then towards the end of 1941 was that a very fair degree of success had been achieved at Eruvikulam, a few thousand fry having been liberated there, fully stocking the river. Two hundred had also been taken below the falls into Turner's Valley. The Devicolam Loch had been stocked again with a thousand fry, and a few hundred had been liberated in the lake at Chittavurrai. The promise of some good fishing the following year was assured, but the membership of the Association had dwindled to 7!

While the waters in the Eruvikulam area had proved suitable breeding streams, it was felt that without a proper hatchery nearer home, waters such as Devicolam, Kanniamallay, Loch Finlay and Rajamallay, could not be stocked and maintained. With encouragement from Mr. Francis, and backing from the Directors of the Company, it was decided therefore to attempt the construction of a hatchery once more, this time on Rajamallay Estate, and the work was commenced on 1st August 1941.

V.—HATCHERY CONSTRUCTION AND MANAGEMENT.

The choice of a site for a hatchery is dependent upon an adequate supply of water from an uncontaminated source, which can be guaranteed to flow at a low temperature during the hatching months. This condition would of course be best realised if a suitable rock or ground spring could be found and such a place would be ideal for the erection of a hatchery. The source of a river, or close to the source of a river and beyond all cultivation, would also be appropriate, but here care should be taken to choose the correct point from which to lead off the water. A good position to 'tap' a stream would be at a fall or cascade, or immediately below it, where the water would be well charged with oxygen, but in most cases where water is taken direct from a river it is necessary to make one or two silt traps or settling tanks in the water course to obviate trouble from sediment.

At Rajamallay the intake was chosen near the bottom of a cascade about one mile below the actual source of the river and above the cultivation. The water is led into the hatchery through earthenware pipes, and over a series of silt traps, and it has been found that during the hatching months the temperature of the water in the hatchery itself never exceeds 58°F. while in the early mornings it is often as low as 48°. For the breeding of trout these figures have proved very satisfactory but it is thought that anything over 60° approaches danger mark for the hatching of ova. Our hatching period is generally between November and the middle of January when there are often very severe frosts at Rajamallay particularly in the vicinity of the hatchery. The mean reading during the season 1942 was 55° at the hatchery, which is suitable for Rainbows but on the high side for Brown Trout.

Adequate aeration is not entirely governed by the nature of the water. Temperature is also an important factor, for it has been shown that the lower the temperature the higher will be the oxygen content. As temperatures in the South Indian Hills are on the high side, it is therefore all the more essential that the intake for a hatchery should be from high falls and rough water to compensate as much as possible for the higher temperatures expected.

Having satisfied ourselves that our water supply and temperatures are efficient, we next turn to material for the construction of our building, bearing in mind that the two greatest enemies we have to defeat are SEDIMENT and FUNGUS. The former can only be overcome by a perfect system of filtration, while defence against the latter is plain CLEANLINESS.

In England hatching troughs were at first made of wood. Disease from a fungus of a kind thriving on wood lying under water frequently developed and large hatches of ova were lost. The signs of this are that the eggs appear slimy, sodden and lifeless, and that they exude millions of small hairs which break off, and floating down the water infect all eggs with which they come in contact. An improvement on the wooden hatching trough was made by charring and varnishing the timber, but in the East, where the dangers of fungus are even greater due to the warmer water, tar was applied, though Mr. Philip Fowke who has described this in his excellent book *Trout Culture in Ceylon*, states that this further precaution is insufficient to guarantee immunity. Acting upon Mr. Fowke's advice the troughs at Rajamallay were constructed of reinforced concrete.

The head tank of the hatchery measures 3′ × 3′ × 3′ and is fed through earthenware and concrete pipes for a distance of 400′ from the main river. The water from the head tank is controlled by a wheel valve which supplies the distributing trough the dimensions of which are 11′ × 15″ × 15″. The water from the distributing trough is controlled and distributed into two filters. These filters have eight partitions through which the water must travel. Provided the sand and gravel in these filters is of the correct consistency no clogging will take place from sudden spates and silt deposit, during the hatching months. This point must receive very careful attention each year. The hatching troughs are 10′ × 2½′ × 1′ which gives sufficient space for about 50,000 eggs provided glass grilles are used. The ideal method of hatching out ova is on glass grilles.

We have already described at some length how to deal with imported eyed ova, so let us now turn to the question of our own ova and how we must obtain it and hatch it out.

In the first place we are told the progeny of pond fish are never so strong and hardy as that of wild ones. While this is partly true it is not always possible in the early stages of such a project as ours, to obtain the eggs of wild fish, and a makeshift arrangement for taking the ova of pond fish becomes necessary.

Stripping.—The pond spawners usually commence running up the channels at the end of November, but in 1942 only a small proportion of the fish from which we had hoped to obtain eggs, came up the run. A modicum of success was obtained and the first Rajamallay Trout were hatched out on the 31st December of that year. These trout, about 600 of them, did very well and developed into strong sturdy fish.

The ideal method of stripping has been dealt with many times in books on the subject, such as Mr. Fowke's work referred to earlier. Briefly the system is as follows:—When the trout first begin to run and show signs that spawning is near, it becomes necessary to make an occasional examination of the fish. The run is screened above and below and the fish netted and placed in a bath filled with river water. In handling fish the utmost care must be exercised to avoid removing scales which is apt to cause fungus. It is recommended that wet gloves or a wet towel be used. The fish should be gripped firmly with the right hand above the tail, and gently above the shoulder with the left. The slightest pressure with the left hand down the back is sufficient to start the eggs flowing if the hen is ripe, but if the eggs do not flow she should at once be returned to the water. On no account should eggs be *forced* from a fish. To facilitate the work the male fish should be kept in a separate bath and the minute the eggs of the female have been stripped into a *dry* basin, a male is taken and similarly the milt expressed on to the eggs. The process should be undertaken slowly and deliberately remembering that it is possible to keep a fish out of water for at least a minute. Difficulty is often found in obtaining sufficient milt. Mr. Fowke recommends the use of as much milt as possible, and if the male refuses to part with his milt the immersion of the fish in a pail of warm water will relax his organs. We have found at Rajamallay that by touching the vent of the cock fish on the eggs a good flow of milt can be obtained. Very little practice is required to differentiate between the sexes, the head and shape of the mouth in the male fish being distinctive. The fish should all be stripped in rotation into the same basin, tilting the basin from time to time thus mixing the eggs and milt together. Five minutes after the last fish has been stripped pour cold water over the eggs and place the basin in a shady place. Tilt the basin every five minutes until the eggs tend to separate and float. They should then be rinsed with cold water several times until the dead milt has all been removed when the eggs are ready for the hatchery. The actual stripping is called the *Dry* method but inevitably a certain amount of water is spilled into the basin during the process. However keep the operation *as dry as possible* until the fertilisation has been completed. The eggs are now gently poured into a jug of cold clean water and taken to the hatchery. In 1943, 14,000 ova from pond and wild spawners were taken and 70% were hatched out successfully.

Grilles versus *Gravel.*—The floors of the hatching troughs at Rajamallay are usually covered with fine carefully washed gravel. This is undesirable, but is the only alternative to glass grilles known at present. Glass grilles are unobtainable in war time and those in our possession, which were sent over from the old hatchery at Arivikad, are insufficient for our purpose. The eggs however which are hatched on glass grilles are better in every way and a much higher percentage of success is obtained with them. The case for and against is very well set out by J. J. Armitead in his *Handy Guide to Fish Culture*, written in 1890. The main points are:—

GRILLES	GRAVEL
1. Sediment goes to the bottom and the eggs are kept clean.	1. Sediment goes to the bottom and the eggs are in close contact with an accumulating mass of filth.
2. Deposit resting on the eggs can be easily removed.	2. Such a deposit cannot be removed without stirring up more filth thus making matters worse.
3. Destructive insects easily detected and removed.	3. Insects cannot be detected hidden as they are amongst the gravel.
4. Dead eggs easily detected and removed.	4. Dead eggs may remain hidden for days infecting others.
5. Water flows under, over and round the eggs, which thus obtain the maximum amount of benefit.	5. Eggs do not get full benefit from the flow of water and the mortality is higher.
6. Fungus easily detected and removed.	6. Fungus could thrive undetected amongst the gravel.
7. The grilles can be lifted out before the eggs hatch, and the bottom of the trough cleaned.	7. The gravel cannot be removed until the fry have hatched out.
8. The eggs can be accurately counted.	8. The eggs cannot be counted easily or without disturbing them.

It follows therefore that at Rajamallay glass grilles will be used exclusively as soon as they can be purchased in sufficient quantity.

Having stripped our eggs and taken them to the hatchery as already described, they are poured gently on to the grilles, or gravel, and developments are awaited. During this period the eggs are in a very delicate condition and great care and attention must be exercised by the attendant. They should not be moved in any way and examined only very occasionally. At Rajamallay the troughs are covered with wooden frames to which is tacked dark blue veiling which, while excluding light, yet admits sufficient air.

The Hatch.—About the fourteenth or fifteenth day an egg with an eye is observed and a few days later the whole lot have the eye of the embryo fish in evidence. The eggs are now 'eyed' or fertile and are strong enough to stand handling. It is in this state that they are shipped from home to many parts of the world. About the 28th day the eggs begin to hatch. The egg cases split, tails appear, and then with much wriggling and struggling minute fish, queer looking freaks, emerge and drop to the floor of the hatching trough exhausted. The 'alevins' as these are called tend to lie huddled together in all corners or crevices concealed from light. Trout have no eyelids and to them light is painful and distressing. Their protection in this respect is of great importance in this country. When all the alevins have hatched out the egg shells must be cleared. This can be done by increasing the flow of the water from the filter troughs and collecting the shells when they gather on the screen at the outlet. Nature provides the newly born fish with a yolk sac on which they exist for the first days of their life. This sac is gradually absorbed and now the alevins must be fed.

Alevins.—In the alevin stage the hatchery probably requires less attention than at any other time, but it is necessary to see that all possible crevices or flaws in the hatching troughs are filled up, for any possible exit will soon be discovered. The alevins may well be described as a 'suicide squad' for in their efforts to hide they will endeavour to bury themselves in the smallest cracks in the structure of the trough. Some years ago we were conducting an experiment with hatching boxes in the river at Eruvikulam. The boxes had been very carefully made, the corners and bends in the sheeting having received special reinforcement. A good hatch had been obtained from the ova and all the boxes were full of splendid little alevins. Owing to pressure of work the boxes had not been visited for some days, and our attendants, alas, lacked powers of observation. When we arrived on the scene of action we were greeted with smiles and the news that 'all was well'. On looking into one of the boxes however, we were horror-struck to find that about half the alevins had disappeared. The attendant was adamant that the box was exactly as when last inspected, but a careful examination revealed the tiniest crack in the zinc sheeting through which it would seem that nothing could have escaped. However it was indeed through this crack that some several hundreds had made their escape, because we watched it happening then and there, and later found a few of the alevins in the bed of the stream. In the same way numerous fry were lost, shortly after they had commenced swimming, from a small earth pond the sides of which had been inefficiently plastered. To be absolutely safe hatching troughs should be of concrete or glazed tiles, and the first fry ponds or grading ponds as they are called, made of carefully plastered concrete.

After a few days the alevins will not 'pack' so much together, and will begin to dart about and swim. At this stage the filters can be removed one by one, *for now the sediment so dangerous to the ova is food for the rapidly developing fry.* Then comes the great day when arriving at the hatchery we lift off the covers to find a swarm of healthy fry battling against the current at the head of the trough.

Fry.—Our hatch has been a success, and we experience a not unnatural glow of satisfaction and a feeling of pride in our achievement. But it is no time to sit back and take things easy. Many fish farmers look upon this as perhaps the most important time of all, for the fry must be fed. Four times a day the yolk of a hard boiled egg is squeezed through a handkerchief and sent down the stream in a cloud. The fry dart at it continuously and from day to day we watch them steadily improving in size and condition. Mr. Fowke in his book lays down that the Golden Rule in feeding fry is a LITTLE AND OFTEN. As the fry develop the size of the feed is increased, and now we feed them, still with the yolk of egg, but administered through an ordinary tea strainer. Care must be taken to avoid administering food too large, or the fry will choke.

Feeding.—Next we augment the diet with a fine liver mince, with which we continue until the time comes for the fry to be removed to the grading ponds. Now comes the question of HOW MUCH food to give the fry. A Head Keeper from Aberdeenshire stated that he always found this question difficult, and he could not judge the proper amount to give them, but recommended putting half the hatch in a slow running stream to find food for themselves. However it is impossible to overfeed fry and it is therefore better to err on the generous side. There are four grading ponds at Rajamallay and here the fry remain until they are big enough for the stew ponds. The necessity for grading ponds is on account of the divergence in the growth of fry usually experienced and also on account of the fact that the fish should be introduced to depth of water by slow stages. The diet has been steadily increased and now pastes made from vegetables, dried fish and meat are given. The greatest care must be exercised in regard to feeding hatchery trout. In the early stages the administration of the yolk of eggs and liver mince presents little or no difficulty but as the fry develop and increase in size our food bills mount accordingly. The result is that we are tempted to explore methods of economy which to the uninitiated may well spell disaster. Under the paragraph on diseases a good example of the kind of thing that can easily occur is given. We find that the best possible feed for developing fry from the six month to the yearling stage is beef or mutton chopped, and passed once through the mincing machine. This is mixed together with carrots, peas, beans, cabbage or potato which have been well cooked. The peas and beans should be soaked for 24 hours and then boiled for four hours, which ensures the food being soft. Any sudden change to a hard diet is apt to injure the stomach walls. Liver, dog biscuits offer an useful variation.

In the High Range the pink flesh of the trout proves that the water is prolific in shrimps. If these are caught they present the perfect food for trout. Termites have been offered to fry on numerous occasions with success.

A year later the fish are sturdy little chaps many of them 6″ in length and ready for their final journey to the rivers and lochs where they must look after themselves avoiding, if they can, the Silver Doctors, and Teal and Reds which seem to appear so regularly at Week-ends !

Diet.—In feeding fry it must be remembered that a wholly meat diet is detrimental to female fish, diseased ovaries being the almost certain result. A balanced diet is essential, in which vegetable foods should play a prominent part. In *Fish Farming for Pleasure and Profit* by 'Practical' much useful information on this subject has been laid down but it has been found difficult in Travancore to follow the ideals set forth, such pastes as the author recommends being unavailable.

Natural Food of Trout.—The Eruvikulam and, indeed, all our streams were, before the advent of the Rainbow, full of a small indigenous fish known locally as 'Kal meen' *Glytothroax Madraspatnus* (Day). It is now nearly a year since we saw 'Kal meen' in number at Eruvikulam or Turner's Valley and so we can safely assume that these small fish present a very desirable item on the Rainbows menu.

Fresh water crabs, beetles and molluscs of all kinds are prolific in our streams, but these too are rapidly disappearing at Eruvikulam, where much harm has been done by overstocking.

Hatches of fly resembling familiar members of the Ephemeridae, such as the Blue Dun have been seen at Eruvikulam, while at Rajamallay caddis flies (*Trichoptera*) have been frequently noticed. The most common rise however seems to be to a small black midge of the Diptera order. It would be of invaluable assistance to us in our work if all anglers took a keen interest in insect entomology and sent in their reports. Much study is required, and a typical High Range stream on Rajamallay Tea Estate has been left unstocked for observation purposes.

Experiments with the production of water fleas and such animals, which are collectively known as plankton, by means of artificial ponds, the bottoms of which have been covered with manure, are being undertaken. The principle is that the nutrient matter derived from the manure will, if exposed to light, grow an enormous quantity of minute green plants which is the food of plankton animals. Given such conditions plankton will increase with amazing rapidity and can be used as food for fry. Snail beds are being put down at Rajamallay and also the dams and deflectors now being made in the upper waters are bound to have a beneficial effect on food conservation generally.

It is necessary to reiterate the word *cleanliness* when dealing with fry in the hatchery. The scrupulous cleanliness of the hatching troughs is more than ever essential, because fry are subject to sickness and disease. At Rajamallay the fry are changed from one trough to another weekly, and the sand and gravel replaced with a fresh supply, a stock of which is kept ready and washed outside. There is a simple tonic for fry if weakness of any sort is discovered. A paste of mud from the underside of a turf is released at the inlet and as the mud cloud filters through the water the fry are seen darting here and there to avoid it. Finally when the cloud clears the fry are seen darting about fresh and invigorated. At Rajamallay we give a dose of this earthy water as a matter of routine. This tonic was first described many years ago by the well-known fish culturist, Livingstone Stone. Mr. Fowke mentions nibbling a very irritating habit in which fry indulge. They nibble the tails of their fellows which then become liable to fungus. Strangely enough we have not so far come across this distressing vice at Rajamallay, but nevertheless we are taking care to spread out the fry as much as possible, and attend to grading and regular feeding.

To sum up, the two most important factors in hatchery work are: 1. *Caution*, do not hurry but take things slowly and deliberately, and 2. *Cleanliness*. These are golden rules which will repay a thousandfold if carefully followed.

Deformed Fry.—Deformed or twisted fry are, alas, common in a hatchery. There may be several reasons for this, but it is probable that some accident occurred such as the egg being knocked against a stone, or in the effort of breaking forth from the egg, perhaps, a little spine may have become damaged, so that we find fry with twisted backs, or peculiarly shaped heads, swimming about with the others. Siamise twins are by no means uncommon, but we have never succeeded in keeping these alive for any length of time at Rajamallay. We think it is rather cruel to keep these little deformities alive at all, and only the most vigorous ones are liberated in our stream. From June 1941 to January 1945, approximately 36,000 perfect trout were hatched at Rajamallay.

Diseases of Trout.—At Rajamallay no sign of disease of any kind crept in until 1943. One day however we noticed several of the yearlings making for the still water, turning over and over, and in one case a fish had fallen to the bottom. Mr. Fowke in his book stresses the appalling nature of a disease called GYRODACTYLUS which is very infectious. The cause is dirt, and the remedy, to remove all the fish to clean water and thoroughly clean out and lime the pond. It was found that the attendant had been careless and omitted to clean the pond daily as a matter of routine. Fortunately for us there was no recurrence of this disease. Another fish was found to be suffering from BLACK OPHTHALMIA, an eye affection. The symptoms are that the fish turns almost jet black in colour. The cause of the disease is said to be unknown, and it is not infectious.

During 1943 the vexed question of the cost of fish food led to a minor disaster. KOONIES, a type of small dried prawn readily available at a cheap rate, were being administered together with such vegetables as were available during the monsoon. One morning the hatchery attendant reported that the fry were looking 'off colour' and tending to fall back to the outlet end of the pond, where the current is slow. This is generally a sign that fish are weak, and on examination it was found that many were lying at the bottom and dying in some numbers. All the usual first aid precautions were taken. The fry were moved to a spare tank supplied by water from a fresh source, and used for just such an emergency. The feeding was stopped for a day and the old tank cleaned and limed. Things seemed to be better a day later, but deaths now began to occur amongst yearling trout. It was then discovered that the 'Koonies' being given were very old and smelling badly, and further that much of it was rotting in the tanks, which had not been properly cleaned. The stomachs of many fry were cut open and carefully examined and here it was found that the intestines were full of mucus and blood, and that the stomachs had contracted to a pin head. Dr. Finlayson, Chief Medical Officer to Messrs. James Finlay & Company's High Range properties, sent intestinal and stomach smears away for examination, with negative results. He was of the opinion that a gastro-intestinal infection of the Salmonella group of food poisoning organism had occurred as a result of the type of food being given. The infected ponds were now given an application of a *few grains* of permanganate periodically, and feeding was commenced gradually, using fresh liver. In a week the deaths had ceased altogether, and within a month our trout were normal again and all swarming close to the white water at the intakes of the ponds. While the actual type of infection has not been definitely settled there can be no doubt that unsuitable food in a state of putrefaction was the origin of the epidemic, and the attempt to reduce feeding costs had proved false economy.

It is interesting to note that the trout born and bred at Rajamallay and being graded in a separate set of ponds withstood the epidemic, and not a single casualty occurred among them.

Selective Breeding.—While all this work would appear at first sight to be satisfactory enough, we would do well to look back and discuss, in some detail, our weaknesses and to look for ways and means of improving. We had an opportunity of visiting the hatchery at Howieton, in Stirlingshire, in 1935. Sir Ramsay Gibson Maitland Bart, who founded this hatchery, laid down in his *History of Howieton* some invaluable instructions on management. We were unable to obtain a copy of this work, but received some very valuable information from one of the attendants in charge. At that time it was a little difficult to put forward many questions, for the simple reason that the idea of a hatchery at Rajamallay had not then been conceived. On looking over our notes on the visit, however, we recently came across numerous points, which in conjunction with our recent experiences prove interesting. To begin with the Howieton people distrust the produce of breeders which have been confined, even if these were originally wild fish. This distrust arises from the instance of animals in zoological gardens, the progeny of which are seldom satisfactory. But when trout become domesticated and their individual characteristics understood, it is possible within a period of time to go in for selective breeding from known stock, in the same way that horses, cattle, or prize rams are bred. The confinement of breeders then ceases to become a makeshift, but is the primary factor in the development of the required stock. Just how this statement relates to the particular breed with which we are dealing is not yet fully understood, at any rate by us, but the problem is one worthy of considerable study.

There are three primary factors in the incubation of trout.

NO STRONG LIGHT. NO SUDDEN CHANGE OF TEMPERATURE. NO STAGNANT WATER. Light injures the nervous system and develops ophthalmic trouble; sudden change of temperature injures the venous system; stagnant water injures both. The three factors are receiving careful attention at Rajamallay.

It has been noted that the waterflow at the Rajamallay hatchery is controlled by a wheel valve. There must always be sufficient flow of water to impinge upon each individual egg, thus sweeping off the carbonic acid gas continually produced during the formation of the embryo. This is particularly important in the period immediately preceding the hatching. Insufficient stress seems to have been laid by the experts in India on the question of space in the hatching trough: Eggs should be separate if at all possible, and should on no account touch one another. This is more than ever necessary when eyed ova is being put down. Eyed ova must have the correct flow of water or otherwise the embryo will be suffocated—drowned in fact. The water flow should be equal to three gallons per minute for every 10,000 eggs. Thirdly the level of the water should be lowered to within an inch of the eggs but this can be raised to three or four inches as soon as the hatch is on.

Now while space at Rajamallay is ample, there have been several instances of overcrowding, particularly during the period when river hatching boxes were used. But without the exclusive use of glass grilles it is almost impossible to keep the eggs separate one from the other. A lower death rate can be anticipated when this difficulty has been overcome.

Ponds.—The general principles governing the construction of ponds are shade, food and facilities for draining and cleaning the pond, and water supply. Particularly in regard to Rainbows, shade should have primary consideration. Ponds running north and south with heavy shade are recommended. Without shade trout won't live, and without food trout won't grow. Ponds should be so constructed that artificial feeding is made easy, every portion of the water being within throwing distance. If trout are to be kept at the hatchery with a view to size and growth, it must be borne in mind that deep water breeds short deep trout, while shallow swift currents breed them long and slim. If trout are to be grown large they must have range, and ponds must therefore be constructed accordingly. The present policy at Rajamallay centres round the stocking of virgin rivers throughout the concession and it is therefore sufficient to grow yearlings only. These have been found to do well in all the waters so far stocked, but the other points mentioned will have to come up for consideration some day. We are of the opinion that at Devicolam, for example, we will soon be compelled to stock with two-year olds, as the feed here is rapidly being used up, and it is said that there are many trout in the water with cannibalistic tendencies.

(*To be continued*)

THE GIANT FRESHWATER FISHES OF ASIA

BY

DR. E. W. GUDGER, C.M.Z.S.

American Museum of Natural History

New York City.

(*With 4 plates and 4 text figures.*)

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INTRODUCTION

Some time ago I set to work to answer the oft-asked question —'What is the largest fish'—but I soon saw that the freshwater fishes had to be studied apart from the marine forms. Then, because there are so many large freshwater fishes worthy of consideration, it became clear that, to keep the articles within bounds, these fishes must be studied by continents. For North America, the great white sturgeon of the Columbia River and the huge alligator gar of the Mississippi and other rivers flowing into the Gulf of Mexico were figured and measurements and weights were given. For South America, this has been done so far as possible for the Pirarucu of the Guiana and Amazon rivers, and for the giant catfishes of the Guiana, Amazon and La Plata Systems. For Africa there is only the great Nile Perch, which was worshipped and mummified by the ancient Egyptians 25 centuries ago, and whose portrait was painted as early as 2780 B.C.

And now, passing by Australia, which has no freshwater fish qualifying for this category, attention will be given to certain giant fishes in the rivers of South-eastern Asia, the greatest continent. Little is known of these and that little is published in books and journals not generally accessible. Hence the bringing together of these data, to make them known to those interested, while difficult, has seemed worth while.

The Giant Fishes of India.

There are in this great peninsula, two fishes which have long been held to be the largest freshwater fishes of the largest continent. Because of this belief, because they are the two largest fishes in India, and because of the presence of kindred fishes in the neighbouring peninsula of Indo-China, with which they will be compared, they must be considered here.

The 'Mighty Mahseer', **Barbus tor.**

This great cyprinoid fish has been exploited under the designation noted as the largest sporting (rod and reel) fish in Indian waters. Chiefly because of this exploitation, I have, in the absence of definite knowledge, long thought it to be the largest freshwater fish of Asia. So, expecting to get the facts to confirm this belief, I confidently went to H. S. Thomas's 'The Rod in India'. But to my disappointment, while this contains much data on angling and on specimens which are fairly large, from our standpoint there is little to justify the cognomen—'Mighty Mahseer'.

However, Thomas quotes from a letter written him by G. P. Sanderson (author of *Thirteen Years among the Wild Beasts of India*) concerning a huge specimen which he caught but was not able to weigh. Sanderson estimated it at 150 pounds. 'I had no means of weighing it, but I found it was as much as I could lift a couple of inches off the ground by hugging it in my arms; no one but a big Mussalman peon in camp could do so much as this. . . . I have since lifted a man of over 10 stones [140 pounds] with greater ease than the fish'. This fish was only 60 in. long over all, but was 38 in. in greatest girth. 'It was an astonishingly thick and heavy fish for its short length. It had shoulders like a bullock.' Then Sanderson adds 'I have no doubt that they run over 200 or 250 pounds, as I have seen teeth and bones of them larger than those of my 150-pounder.' These are of course only general estimates, not scientific records, but coming from G. P. Sanderson, they cannot be cast aside as wholly valueless.

The figure of *Barbus tor* reproduced herein (Fig. 1, pl. I) is copied from Thomas. It is the almost exact counterpart of the splendidly mounted skin in the Fish Hall of the American Museum. This skin, which came from India a number of years ago, is 57 inches long to the base of the caudal fin, and 64 inches long over all. The scales are very large. The largest ones just behind the operculum average about 3.2 in. in vertical diameter. Both figure and mounted skin show the Mahseer to be a clean-cut handsome fish. It is a fine sporting fish, and this may explain why it is called Mahseer. Thomas quotes a Persian scholar that the name is derived from the Persian *mahi* a fish and *sher* a lion, in allusion to its gameness.

The illustration reproduced herein is a splendid drawing of *Barbus tor,* but it gives one no idea of the relative size of this great carp. However Thomas has, embossed in gilt on the cover of his book (2nd ed., 1881), a figure showing a mahseer seemingly about five feet in length swung up to a limb of a tree. Leaning against the trunk of the tree is a man about five and a half feet tall. This illustration gives one a very good idea of the relative size attained by this great cyprinoid.

Sanderson states that another and slenderer specimen measured 5 feet 6 inches but weighed only 80 pounds. This fish was large but it is not a record fish. However, two high records have been made by C. E. Murray Aynesley. In 1906 he captured the largest mahseer of which any account has been found. Its length was 60 in.; girth 37 in.; mouth 8.5 in. across; tail-spread (vertical) 19 in.; and weight 104 lbs. He fought this fish two hours and it took two men to land it. In 1909, he records another and only very slightly less heavy. It was 64 in. long; 39 in. in girth; mouth and tail as in the other fish; and 103 lbs. in weight. This fish was also so large and powerful that two men were needed to bring it ashore. The Mahseer probably grows larger as Sanderson suggests, but so far no records of larger specimens have been found.*

The Goonch, **Bagarius bagarius.**

There are in India several catfishes which furnish great sport to anglers. Some of them are so large, have such formidable

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* In Vol. xliii, No. 4, p. 662 of the Society's *Journal,* we published a note by Col. R. W. Burton, giving details of record mahseer. A mahseer (*Barbus tor*) taken by Lt.-Col. J. S. Rivett-Carnac, in the Cauvery River, 44 miles from Mysore, on the 28th December 1919, measured as follows:—length, 64 in.; girth, 42 in.; weight, 119 lbs.

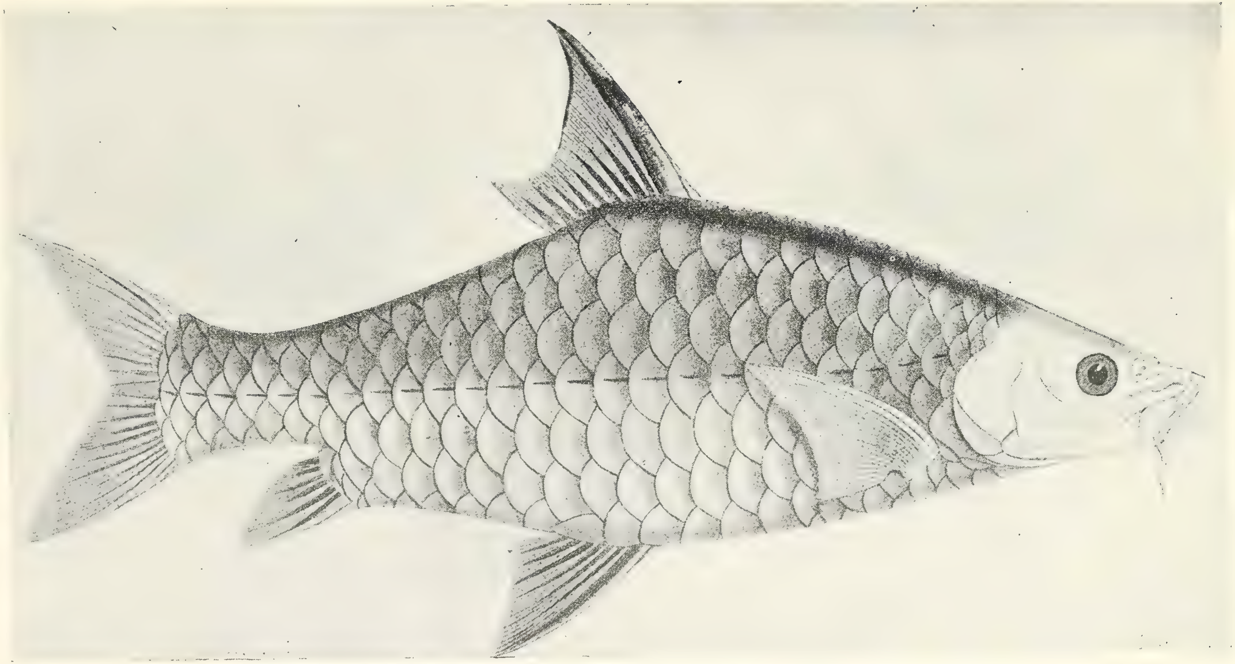
A second specimen taken by Mr. A. E. Lobb, in the Kabani River, 65 miles from Mysore, on the 22nd October 1938, measured as follows:—length, 60 in.; girth, 38 in.; weight, 110 lbs.

A third specimen of this species caught in the Cauvery River near Seringapatam on the 15th January 1920 by Mr. de Wet Van Ingen, measured as follows:—length, 62½ in.; girth, 38½ in.; weight, 107 lbs.

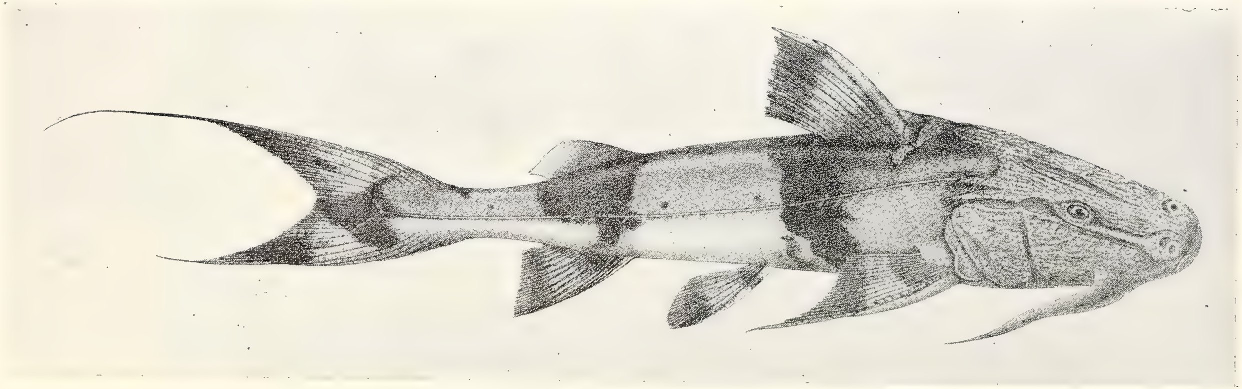
Col. Burton commenting on these measurements says: 'It is interesting with these large mahseer to refer to *The Rod in India,* where the measurements of a mahseer, believed by Sanderson to have weighed 150 lbs., are the same as those of Mr. Lobb's 110 lbs. fish.'

Photographs of the 119- and 110-lb. fish were published with the note and give a good idea of the relative size of these great fishes as compared with the men standing by.

The genus *Barbus* includes yet another Asiatic large carp [*Barbus esocinus* (Heckel)]. A specimen measuring 6 ft. 4 in. in length and 3 ft. 10 in. in girth and weighing 215 lbs. was caught in the Euphrates River at Hakika, Mesopotamia, in 1917 (*J.B.N.H.S.*, xxv, 308) it was at the time wrongly identified as *Barbus scheich* (Heckel). A second example of the same species, 5 ft. 9 in. long, 3 ft. 2 in. in girth and scaling 123 lbs. was caught by Major H. L. Colan, I.A., in the Diala River, Mesopotamia, in 1918 (*J.B.N.H.S.*, xxvi, 679). A photograph of this fish carried by four men on a pole gives a good idea of its size.—EDS.

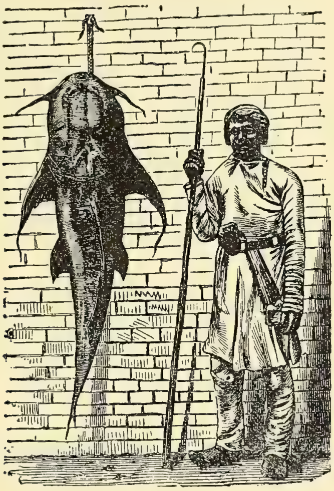


The Mahseer, *Barbus tor*. This drawing splendidly portrays this great carp.



The Goonch or ‘Freshwater Shark’, *Bagarius bagarius*.
Contrast this lateral view with the dorsal one of Text-fig. 1. From Thomas (1881) after Day, ‘Fishes of India’, 1875.

teeth, and are so predatory that they have been dubbed 'Freshwater Sharks'. They are of course not sharks (Elasmobranchs) but catfishes (Siluroids). However the common name does not seem so totally inappropriate when in a lateral view of the largest of these, the Goonch (*Bagarius bagarius*), one sees that the mouth is somewhat 'underhung' like a shark's and not terminal as in the catfishes generally (Hora, 1939). Then again the general ugliness of this fish, particularly when seen in dorsal view (Text-fig. 1), is very repulsive. However, Hora (1939) notes that the Goonch is very variable in both form and color, as may be seen in both his text-figure and color plate.



Text-fig. 1.—A Goonch (*Bagarius bagarius*) hung by the head with the shikari standing beside it for comparison as to size.
After Cyril Kirkpatrick in *The Field* (London), 1875.

The largest of these 'freshwater sharks' on record, so far as I can find, is a Goonch taken with rod and reel in 1875 at the head works of the Agra Canals in the Jumna River near Okhla, India. It was figured and described by Cyril Kirkapatrick in *The Field* (1875). This specimen weighed 136 lbs. and measured as follows: length to fork of tail, 5 ft.; overall, 5 ft. 8 in.; girth of head, 3 ft. 6 in.; width of mouth, 1 ft. 6 in. It was taken on a light rod and fought the angler for over 2 hours. Two men were required to drag it ashore. In the 1897 edition of his book, Thomas states that this was at that time the largest fish that had ever been taken with rod and reel in India.

Text-fig. is a copy of the cut in *The Field* made from a photograph of the fish taken at the time of capture, with the shikari ('a man of ordinary size') standing beside it. From this one readily gets a correct idea of what a big and ugly brute a full-grown Goonch is. However, a better representation is seen in the fine drawing of the fish in lateral view reproduced from Thomas (Fig. 2, pl. I).

Large as this fish was, it probably is not the maximum size. The distinguished Indian ichthyologist, Dr. Sunder Lal Hora, in a late article (1939) on the Goonch, states that '. . . it grows to a size of 6 ft. or more and to a weight of over 250 lbs.'

THE GIANT FISHES OF SIAM.

Large as are the Goonch and the Mahseer, each has one or more relatives in the rivers of Siam larger than it—and indeed, so far as is known at this time, each of these is the largest of its family in the whole world. The progressive development of our knowledge of these great fishes makes a story not devoid of interest and value.

The Pla Biik, **Pangasianodon gigas**.

Our earliest knowledge of this huge siluroid dates back to 1904, when Auguste Pavie published in Paris his 'Recherches sur l'Histoire Naturelle de l'Indo-Chine Orientale'. Pavie 64 years ago headed the 'Mission Pavie l'Indo-Chine, 1879—1895'. This expedition studied the voyages to, the geography, literature, history of this great peninsula, and Pavie published the results in ten thick volumes. Volume III of this series is, as noted above, given over to natural history studies—the various groups of animals collected being described by various specialists. In the introductions to 'Première Classe—Poissons' are found five reproductions from photographs of a huge catfish. The photographs may have been poor; in any case the reproductions are small and lack sharpness—they merely show a massive logy fish. The largest does give some idea of the shape and relative size, but it does not seem worth while to reproduce it, even though it is the earliest known representation of our fish. Splendid figures from excellent photographs will be given later.

In his introduction to the fishes (described by Leon Vaillant), Pavie, earliest of all Europeans, makes known this gigantic catfish, which he says merits particular attention because it often grows to a size of 1-1/3 meters—but which his best photograph shows to be about 6 or 8 ft. long.

Pavie states that the Cambodians call it *Trey-Réach* or royal fish probably on account of its great size. They take this fish in great numbers at the time of the rains in the Mekong off Pnom-Penh, and at the narrows of Quatre-Bras. At this time the fish is very fat and from its flesh much oil is obtained. As the flood in the river subsides, the *Trey Réach* ascends the Mekong and when it reaches Luang-Prabang in February it has lost its fat. At this time the fishermen are on the lookout and when they see the fish, which swims almost at the surface, they set out in many canoes with long shallow nets and bar its passage. The fishing is carried on until June. The flesh is preserved in brine, and of the eggs is made a kind of caviar much esteemed in Laos. The numbers taken at Luang-Prabang varied—1,400 in 1889 and 6,000 in 1890. The Laotians allege that only the females ascend the river, and that the males never leave the upcountry lakes but await the females there.

The Laotians call this great siluroid *Pla boeuk*. It was assigned by the experts at the Paris Museum to the long-established genus *Pangasius*, but the species could not be determined for lack of specimens. Vaillant in his description of the species collected by Pavie, does not list it for the same reason.

Pavie saw the fishing about 1890, and in 1921, A. H. Duke described a 'Curious Fishing Ceremony near Vien Chan on the Upper Mekong'. This fishing was carried on at the time of the full moon in February by the Laos people for a huge fish locally called 'Pla Bük'. About the identity of this animal Duke had doubts and his account of its natural history is at least remarkable, due to the fact that he saw neither fish nor fishing, but merely reported what was told him.

He makes some interesting statements (some true and some untrue about the Pla Büks. Thus—'They are about 12 ft. in length, and 8 to 10 ft. girth have smooth black skins and are scaleless. Their heads are blunt and mouths toothless. The females have a pair of mammae (?). When caught their stomachs are never found to contain anything but stones'. When they are seen rising and ascending the river, then the fishing is undertaken. Only certain skilled men are allowed to do the fishing. Boats laden with long wide-meshed seines go up stream and drop these at certain narrow defiles. The fish blunder into the seines and are caught by the gills. The fishermen come up and guide them ashore, where they are tethered in the water by a rope through the mouth and gills until sold. 'The fish is said to be very powerful, and it is alleged that purchasers living upstream utilize them to tow their boats home.' There is no doubt that one of these huge fish could tow a small boat, but how about guiding this unruly aquatic steed? The flesh is much prized and eagerly consumed by the Laos people.

One such interesting observation when published almost inevitably leads to another. And so two years later Eric Seidenfaden (1923) refers to Duke's account, corroborates it in part and much extends our knowledge of the Pla Bük. Seidenfaden identified our great fish as a siluroid and states that it attains a length of 3 m. (9 ft., 10 in.) and a weight of 240 kg. (528 lbs.). At Vien Chan the fish are driven into a narrow rocky bay where they are easily taken in long narrow nets of rope and each fish is then tethered by a rope through mouth and gills. Seindenfaden saw one so tied and estimated its length at about 2.5 m. (98 in.), its girth at 1.7 m. (67 in.) and its weight at 180 kg. (396 lbs.). Thus tethered the fish in the water lives and its flesh is better even than if kept in a refrigerator. So at the fish wharf in Key West, Florida, I have seen the great grouper called Jewfish so tied to a pile while awaiting customers for its flesh.

Next, F. H. Giles in 1932 records the taking at Chiengsen on the Upper Mekong on July 12, of a large female Pla Bük, which he saw and which he assigns to the genus *Pangasius*. This fish was 87 in. long and had a girth of 50 in. It was much smaller than that seen by Duke. This female was in spawn and while the fish was not weighed, the roe was—88 pounds. It as well as the flesh is esteemed as a great delicacy.

Piérre Chevey had long been interested in the fishes of Indo-China and in our giant catfish, when he journeyed to that country and saw in the museum at Phnom-Penh two casts of this giant each measuring, 2.5 m. (98.5 in., 8 ft., 2 in.). Two years later (August, 1930) he saw in the market of this town a specimen about 2 m. long. On examining it he was surprised to find it absolutely lacking in teeth, and, since *Pangasius* has teeth, it was necessary to set up for this giant a new genus—*Pangasianodon; Pangasius*—*an* without, *dens,* tooth; and species, *gigas* = gigantic. I know no fish more fittingly named. However, strange to say, Chevey, while accurately describing this new fish, reproduced photographs of the two casts but got no photograph of the fish itself.

After a long and distinguished service in the U. S. Bureau of Fisheries—ending with 9 years in the Commissionership—Dr. Hugh M. Smith retired in 1922. But in 1923 he went to Siam and served there until 1935 as Fisheries Adviser to the Siamese Government. While in Siam, Dr. Smith collected material (specimens, notes, and photographs) for an extensive monograph (as yet unpublished) on Siamese fishes. My attention was called some years ago by Dr. Smith to the three species of giant fishes of Indo-China, noted herein.

Mr. Thomas Slack, a resident of Bangkok, presented to Dr. Smith three photographs of a huge Pla Bük taken at Chiengsen on the Mekong in Northern Siam. These Dr. Smith has given me permission to reproduce. Two of them were sent by Mr. Slack to the *Illustrated London News* and were reproduced with notes by himself and Dr. Smith in its issue of August 22, 1931. Mr. Slack saw the huge fish tethered in the water as described above. He had it trussed up and hauled out alive on the bank in order to take the photographs referred to. He measured it and found it to be 100 in. long over all and 54 in. girth over the thickest part. He had no means of weighing it, but estimated its weight at about 400 lbs. This weight seems to me to be at least 100 lbs. too light. Mr. Slack calls attention to the elevated platform from which a lookout warns of the approach of these great fish as they come up stream in shallow water during the dry months (Plate II, Figs. 1 & 2), of the trussed up fish lying on the bank of the river, gives a better idea of the size and make up of this colossal catfish.

Dr. Smith wrote me that at one time he had in preparation an article on the giant catfishes of Siam, but that press of other work had prevented his finishing it. His data will undoubtedly be found in his 'Fishes of Siam', left unfinished by his untimely death in 1941, but brought to completion by the devoted labours of Dr. L. P. Schultz, Curator of Fishes in the U. S. National Museum. The only data he ever published on the Pla Bük appears along with the note and figures from photographs by Mr. Slack (referred to above) in the *Illustrated London News.* Since

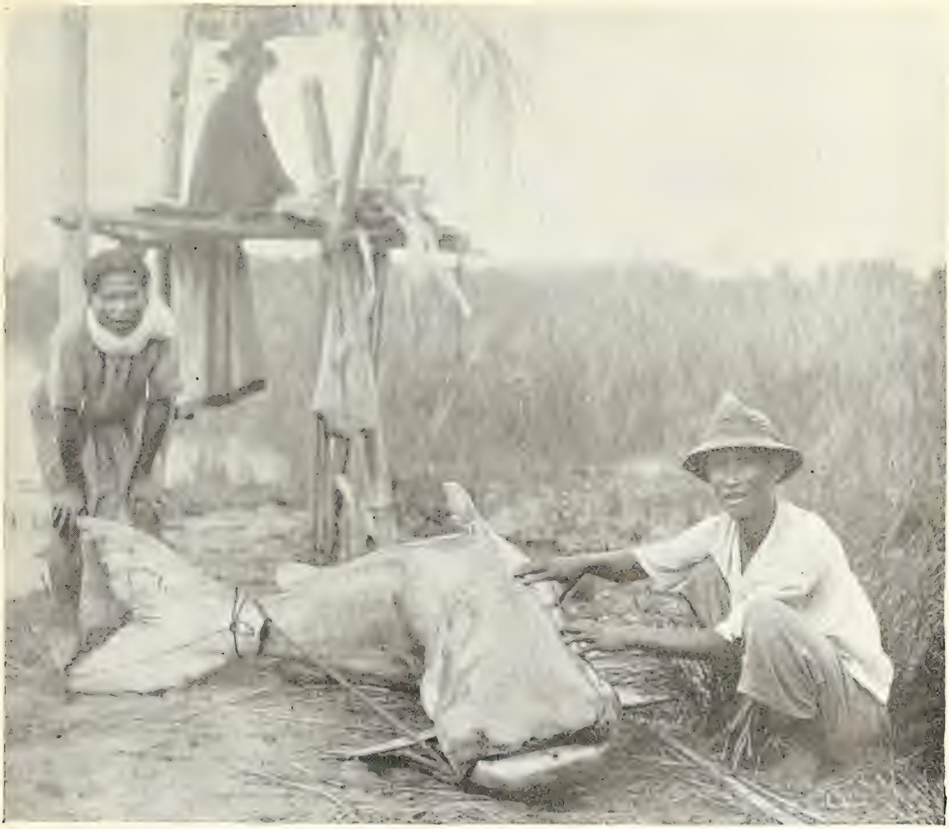


Fig. 1.—Greatest of all known Catfishes, the Siamese Pla Bük of Mekong River. Behind the fish is an elevated platform from which the lookout watches for these giants swimming at the surface of the water. From a photograph by Thomas Slack in *Illustrated London News,* Aug. 22, 1931.

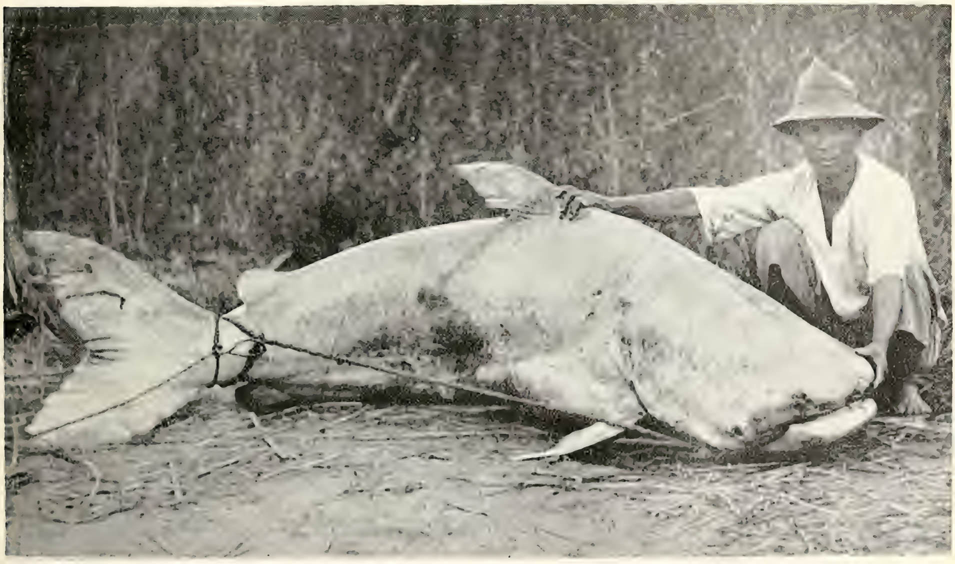


Fig. 2.—The Great Pla Bük (*Pangasianodon gigas*) trussed up and hauled out on the bank of the Mekong River in order to be photographed and measured. From a photograph by Thomas Slack loaned by Dr. H. M. Smith.

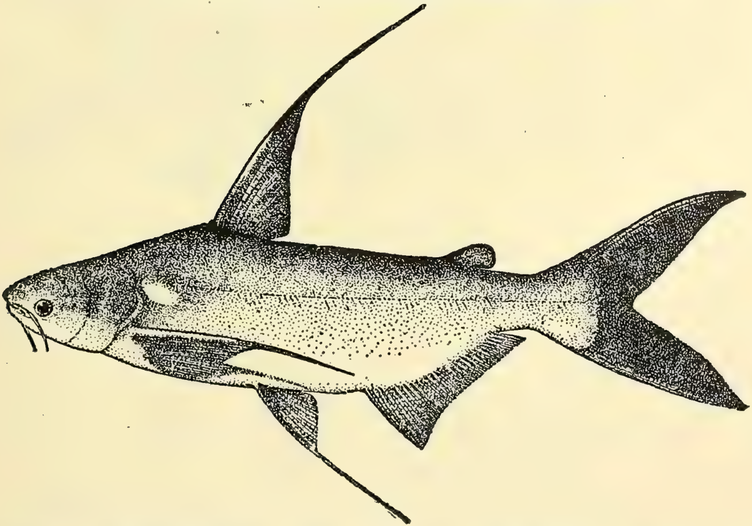
Dr. Smith is one of two scientific men who have seen this great fish alive, it will be of great value to record here his observations.

The Pla Bük is a colossal catfish of the Mekong River, in Siam and Indo-China. It ranges as far inland as Chieng Sen, in northern Siam, opposite the Northern Shan States, and has a well-defined up-stream migratory movement, beginning in February. A fishery, attended by great ceremony and participated in by 800 boats with two or three men in each, has been conducted for many years in a narrow part of the river between Siam and French Laos, near Vienchan. The fishery is held only during three days following the full moon in February and wide-meshed nests made of rope are the only apparatus used. The catch in recent years has been small.

The zoological status of the Pla Bük has been somewhat uncertain. The fish is a *Pangasius*, a genus numerously represented in Indo-China, Siam, Burma, Malaya, and the Dutch Indies, but the specific determination has been made difficult by the fact that no fish with a less length than 1.5 metres has ever been recognized and it is known that fishes of certain species of *Pangasius* undergo considerable change in shape, dentition, and feeding habits with advancing age. The Pla Bük has no teeth, and its food consists wholly of aquatic vegetation, chiefly algae, cropped from stones in the swift waters of the Mekong. A maximum length of 3 meters is attained, but fish over 2.5 meters have been very scarce for many years. A fish 3 meters (118 in., 9 ft. 10 in.) long would probably weigh over 250 kilogrammes (550 lbs.); one specimen, 2.5 meters (98.5 in.) long and 1.7 meters (67 in.) in girth, weighed 180 kilogrammes (396 lbs.). Recently (1930) . . . Mr. P. Chevey has described the Pla Bük as a new species, and made it the type of a new genus, *Pangasianodon gigas*. The new genus is characterized by the absence of teeth, but it remains to be determined whether the character holds good for young and medium-sized fish.

Dr. Smith sent me copies of Mr. Slack's photographs used in the joint article noted above, and reproduced herein, but was unable to find a photograph which he himself had made of a fresh caught Pla Bük which measured 2.47 meters [97.24 in., 8 ft., 1 in.] long.

The Pla Tepa—**Pangasius sanitwongseii.**



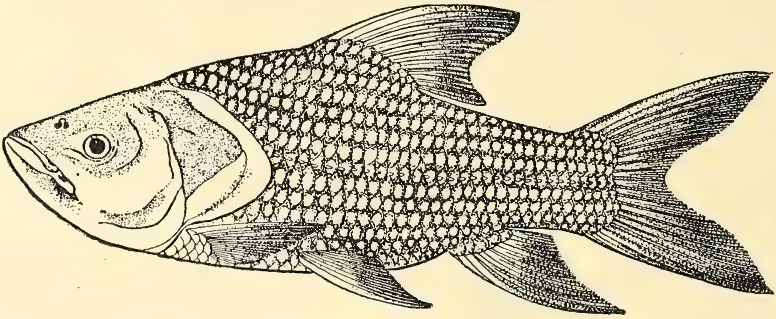
Text-fig. 2.—A giant Siamese Catfish (*Pangasius sanitwongseii*), the Pla Tepa, which has been taken up to 3 m. (9 ft. 10 in.) in length. After H. M. Smith, 1931.

This giant catfish, a close relative and a rival in size of the Pla Bük, is found in the Menam River. It was unknown to science until it was figured and described by Dr. Smith (1931). The figure (a drawing of a fresh or recently preserved fish) is shown herein as Text-fig. 2 for comparison with photographs of the Pla Bük (Pl. III). All these colossal catfishes are so heavy and so soft-bodied that when brought ashore they flatten down. It is a great pity that they were not hung up by head or tail, with a man standing by for comparison. The Pla Tepa, while heavy bodied, is more trimly built than the Pla Bük, has a deeply forked tail with sharp-pointed lobes, and has dorsal, pectoral, and pelvic fins with long filaments—whereas Pla Bük has none of these. But like Pla Bük it grows to great size. Here is what Dr. Smith says on this point:

> In point of size this fish rivals the celebrated *Pangasius* of the Mekong basin called Pla Bük by the Siamese. In former times fish 3 meters (118 in.) in length were sometimes taken, and at least one fish of that size has been recorded within eight years. In recent years, examples over 1.5 meters in length have been rare. . . . Named in honor of Dr. Yai S. Sanitwongsei, . . . who first brought this species to the writer's attention and pointed out its distinctive characters.

The Pla Kaho, **Catlocarpio siamensis.**

The *Barbus tor* of India (Fig. 1, pl. I), of which the record * specimen was 60 in. long, 37 in girth, and 104 lbs. in weight, has long been thought to be the largest Cyprinoid. It is a large fish of its kind, but a larger than it, from the neighbouring peninsula of Indo-China, is now to be considered. I knew nothing of this latter as a giant fish until Dr. Smith called my attention to it. And since nothing has been published on its size, Dr. Smith kindly sent me a copy of the following data from the MS. of his unpublished 'Fishes of Siam'.



Text-fig. 3.—The giant of all carps, the Siamese Pla Kaho (*Catlocarpio siamensis*). Note the huge head and deep body. From Fowler, 1937.

> This is the largest cyprinoid fish in Siam and one of the largest in the world. One taken at Bangkok, November 3, 1923, was 2.5 meters (98 in.)

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* Vide footnote, p. 376.

long, and there are other definite records of examples of this size. Fish up to 3 meters (118 in.) have undoubtedly been caught in the Menam Chao Phya in earlier years. A dried head 42 cm. (16.8 in.) long, in the collection of the Siamese Bureau of Fisheries, was from a specimen 1.61 meters (63 in.) long and 61 cm. (24 in.) deep taken at Paknam, August 24, 1924. A scale from the side of this fish was 6.8 cm. (2.7 in.) long and 5.7 cm. (2.25 in.) wide; a scale from the back near the head was 8.5 cm. (3.4 in.) long and 8 cm. (3.2 in.) wide.

Dr. Smith had a drawing of this magnificent carp loaned by the Siamese government for reproduction in his book, but since the book has not yet been published, the figure is not available. However, he very kindly called my attention to an excellent figure by H. W. Fowler (1937). This illustration is reproduced herein as Text-fig. 3. It shows a huge stocky fish, of relatively great depth and covered with huge scales.

Smith's measurements of the scales give one an idea of the size of the scales in Fowler's figure of this huge carp. As the figure of the Mahseer shows, it also has large scales. In our mounted skin in the American Museum, three scales in the vertical of the dorsal fin average about 80 mm. (3.2 in.) in vertical diameter.

It is now very much in order to compare our two giant cyprinoids, the Mahseer (*Barbus tor*) and the Pla Keho (*Catlocarpio siamensis*) as portrayed in Fig. 1, pl. I, and in Text-fig. 3. The Mahseer is a large fish, but it is trim-built with a small head and pointed snout, and with a deep body having a clear run. One can readily understand that it is a fine sporting fish for Indian anglers. Now let us turn to Fowler's figure (my Text-fig. 4) and note the great contrast. Fowler thus characterizes the genus *Catlocarpio*: 'Body short, deep, compressed, deepest at the dorsal origin. Head very large, robust, long as body without caudal [i.e. tail]. Snout large broad, obtuse as viewed from above.' And further on—'A very curious genus characterized by its remarkable combination of characters.' And then of the most marked organ of all, he writes—'The head is remarkably large.'

When one looks at the well-portrayed fish of Text-fig. 3 one sees the justification for every statement made above. Contrasted with the Mahseer, no one could ever think of the Pla Kaho as a sporting fish. When one remembers that the largest mahseer measured but 66 in. and weighed only 104 lbs., while Smith says that the Pla Kaho has been measured up to 98 in., which fish must have weighed quite 250 lbs., then one is prepared to believe that the Siamese fish is the largest cyprinoid in the world. Such a colossal carp must be very powerful, and on this point the words of a native Siamese writer may be quoted. Thus Mom Chao Vipulya says (1923) that, when a Pla Kaho is hooked on a hand line, 'The fishermen let their small boats be dragged about until the fish is tired, which may take two or three hours.' This recalls the like exploits of the Pla Bük as recorded earlier. Undoubtedly *Catlocarpio siamensis* is the largest and most powerful cyprinoid in the world.

THE GREAT STURGEONS OF CHINA.

It is surprising to find that there are four great sturgeons found in the rivers of China and Manchuria. The crowded millions of China are hard put to it for meat food, but their rivers teem with fishes and the Chinese are great fishermen and fish-eaters. Probably their sturgeons are nowadays not often allowed to attain the size that they formerly did, but here are the facts that I have been able to gather. My colleague, Mr. John T. Nichols, in his forthcoming great report on 'The Freshwater Fishes of China', recognizes four species. All of them are much valued as food.

As shown in the first article of this series (Gudger, 1942), sturgeons have an old if not a 'distinguished' ancestry. They certainly belong to one of the 'F. F. Fs.'—first families of fishes. They are Ganoids, as their rows of large and heavy scales show. These scales are composed of bone with an outer layer of shining enamel called ganoin. Hence the shiny scales of these fishes proclaim their family affinities—they belong to the group Ganoidei. These Chinese sturgeons will be studied in the order of discovery.

The Chinese Royal Sturgeon, **Acipenser sinensis**.

The Chinese call this fish *Huang Yu,* which means Emperor Fish, since, when a specimen is caught, it must be sent to the reigning monarch. This recalls the custom formerly prevalent in England, that when a sturgeon was caught in the Thames within the jurisdiction of the Lord Mayor of London, it was considered a Royal Fish and was at once sent to the King.

The Chinese Royal Sturgeon was described by J. E. Gray at a meeting of the Zoological Society of London, November 11, 1834, and was separately figured in color that same year (Gray, 1834, 2, pl. 98). Gray's splendid figure is reproduced herein as Fig. 1, pl. III. Attention is called to the large and beautifully sculptured ganoid scales on back, side and abdomen.

This sturgeon, while of rather slender build, grows to a considerable size. Thus Sowerby states (1923) that a nine-foot specimen was mounted and on exhibition in the Tsi-nan Fu Institute. He also records one taken in the Dragon River, Fukien, which measured 11.5 ft. and weighed 438 lbs. It was purchased by a wealthy merchant, was photographed and then set free in the Min River at Lim Po. Sowerby unfortunately got no copy of the photograph.

Last of all, for data as to size, I can quote the Chinese naturalist, C. Ping, who (1931) nearly 100 years after Gray stated that 'The Chinese Sturgeon . . . reaches over three meters [*c.* 10 feet] in mature size and is easy to be recognized by the rows of bony [ganoid] scutes along the median lines of the dorsal lateral and ventral surfaces'—as Gray's illustration (Fig. 1, pl. II) shows. It is found in the Yangtze from Woosung to Ichang.

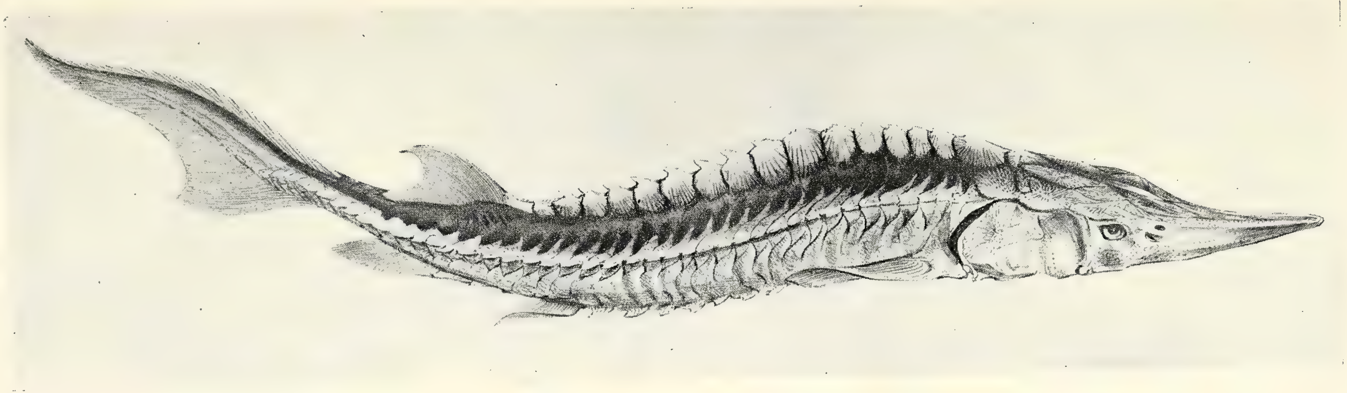


Fig. 1.—The Chinese Royal Sturgeon (*Acipenser sinensis*). Note the beautiful sculpturing of the large ganoid scales. After J. E. Gray, 1834.

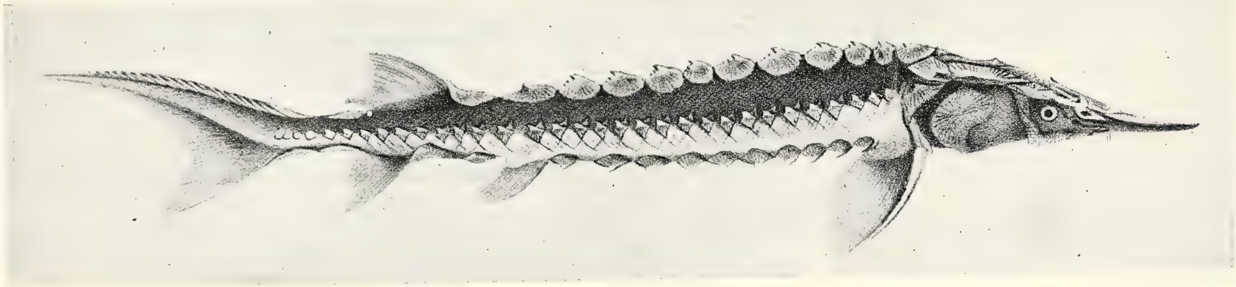


Fig. 2.—Dabry's Sturgeon (*Acipenser dabryanus*). Contrast the scales on the lower side of the body with those of the Chinese Royal Sturgeon. After Duméril, 1868.

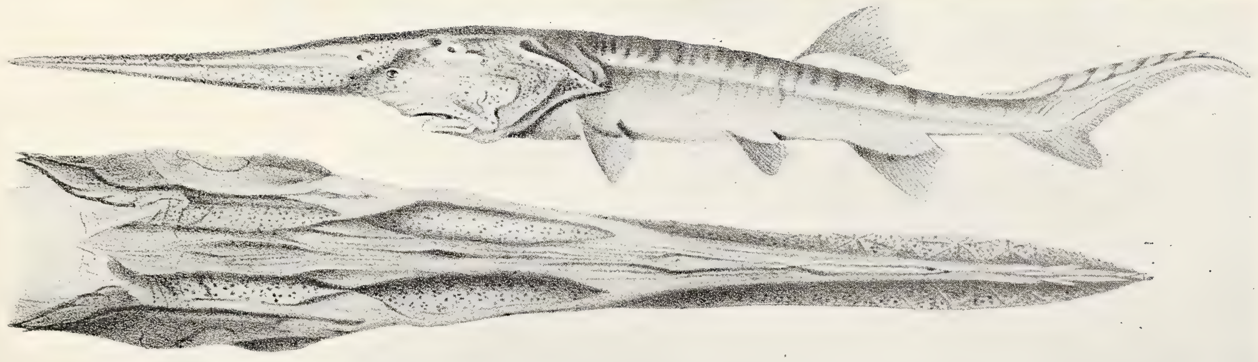


Fig. 1.—The most remarkable of all Sturgeons, the Swordbill, *Psephurus gladius*. The underhung mouth and the long bill recall the Broad-billed Swordfish, *Ziphias gladius*. But underhung mouth and strongly heterocercal tail are also characteristics of a shark. After Duméril, 1868.

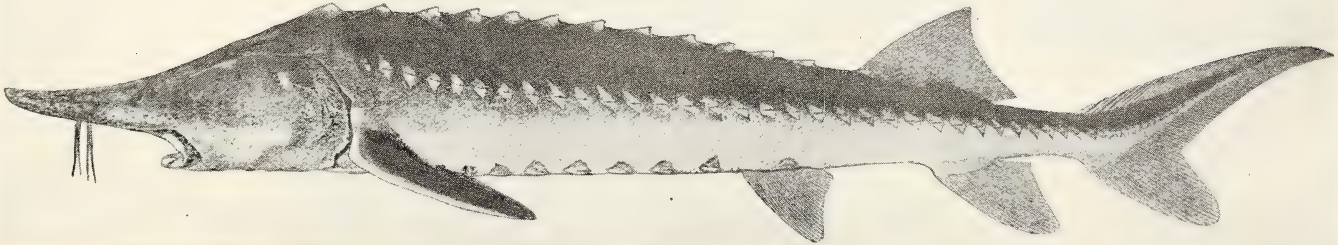


Fig. 2.—The greatest of all Asiatic Sturgeons, the Kaluga (*Huso dauricus*) of the Amur River. Note how much bulkier it is (especially in the forward region) than the Chinese Sturgeons. After Berg, 1932.

The Manchurian Sturgeon, **Acipenser mantschuricus.**

This sturgeon was named and described by the Russian doctor, Stephanus Basilewsky, while a member of a Russian mission to Pekin. He seems to have written his 'Ichthyographia Chinae Borealis' while in China. On the lower left corner of his title page is found the following:—'Pekin, 1852 ann. Januario mense'.

Of the Manchurian sturgeon, Basilewsky writes:—

> 'Longitud. usque 10-15 pedes et longior.
> Pondere ad 300-500 libr. accedere affirmatur.'

These lengths and weights seem to refer to the fish in the Amur River since in the next paragraph he states that 'In winter it is transported frozen (to Pekin?) from Manchuria where it lives in the River Amur'.

This is all very clear and straightforward, but the matter is a bit confused by the next paragraph in which it is stated that 'This sturgeon . . . lives in all the great rivers of Manchuria and Mongolia, and particularly abounds in the "yellow river", *Chuan che* where it attains a length of from 15 to 20 feet and an actual [*vero*] weight of from 1,000 to 2,000 lbs. [*libras*].' It is hard to believe that in these regions such a colossal sturgeon is found. Basilewsky does not say that he measured these giants. Furthermore one wishes to know what are Basilewsky's 'pedes' and 'libras'. Are they our English units? There is no figure of this sturgeon known to me.

The matter of the identity of the Amur River Sturgeon is still further complicated by the fact that neither Soldator in his special study of the *Acipenseridae* of the Amur (1915) nor Berg, the greatest of Russian ichthyologists, in his authoritative work on the freshwater fishes of the U.R.S.S. (1932), refers to Basilewsky or his sturgeon. From this it may be judged that Basilewsky was in error in assigning the Amur River as one of its habitats.

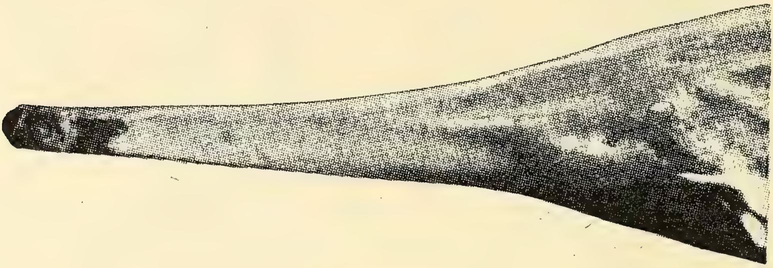
Dabry's Sturgeon, **Acipenser dabryanus.**

This *Acipenser* was named by Auguste Duméril after Capt. Dabry, the French consul in China, who made collections of Chinese fishes and sent them to Paris. Duméril figured and described this slender sturgeon in 1868. He gives no sizes for it, but this deficiency is relieved by Clifford H. Pope who (as a member of the Central Asiatic Expedition of the American Museum) collected the Chinese freshwater fishes which my colleague, Mr. J. T. Nichols, has described. Nichols quotes Pope as saying that 'A big one was reported as seen at the Port four miles below Yochow. There are reported to be two kinds here, and both to attain great size, some 1,500 lbs.' Unfortunately Pope had no data as to lengths.

That this sturgeon is amply supplied with ganoid scales may be seen by reference to Duméril's figure reproduced herein (Fig. 2, pl. IV. However, it is interesting to note the difference between the scales of this sturgeon and those of Gray's *Acipenser sinensis* (Fig. 1, pl. IV) in both shape and sculpturing. This is especially true of those in each side of the body below the line of mid-lateral scales.

The Sword-billed Sturgeon, **Psephurus gladius.**

We are now to consider the most remarkable of all the unusual freshwater fishes of the Chinese empire, and indeed of all Asia. It is found nowhere else in the world, and it has but one close relative, the spatulate or 'spoon-billed' sturgeon, *Polyodon spathula*, found in the rivers of the Mississippi Valley. This latter has the beak much shorter and much broader, spatulate rather than sword-shaped as in the Chinese form.



Text-fig. 4.—The sword and anterior part of the head of a large *Psephurus gladius*. Contrast with the swords shown in Fig. 1, pl. V and note here the shortened blunted bill.

After Rogers, 1935.

In the Hoangho and Yangtze-Kiang rivers of China lives this long, slender sturgeon having the beak prolonged into a sword-like organ comprising nearly one-third the total length of the fish. Lacking a common name I have given this fish that above. Its scientific name is *Psephurus gladius*. These names are interesting. *Psephurus* is derived from two Greek words meaning 'pebbled tail' in allusion to the large overlapping scales on the upper edge of the tail fin—as seen in Fig. 1, pl. IV. The other large ganoid scales, so prominent in the figures of the other Chinese sturgeons, are vestigial in this fish. The specific name, *gladius*, is the Latin for sword, in allusion to the sword-like snout. This is seen not only in the fine figure of the fish but is splendidly portrayed in the separate figure. For these portrayals of both fish and beak, we are indebted to August Duméril (1868).

Little is known about this aberrant and unusual sturgeon. I have been hard put to it to find to what size the fish attains. In an article by the late Dr. Berthold Laufer, distinguished student of things Chinese, on the 'Domestication of the Cormorant', he incidentally remarks that the sturgeon 'is from 20 to 30 feet long'. Now the Sword-bill is distinctively *the* Chinese Sturgeon, but I had always considered the Sword-bill as a relatively small fish for a sturgeon, so I began a search for corroborative data as to the alleged size.

This remark of Laufer's, written with regard to comorant fishing, I have always interpreted as referring to the fish under consideration, since even young ones have less bulk for the length than the young of any sturgeon known to me. This identification I noted in correspondence with Dr. Laufer and he acquiesced. The 'Cambridge Natural History' (vol. VII, Fishes, p. 492) is more moderate than Dr. Laufer. It notes that '*Psephurus* is stated to reach a length of 20 feet'. This however is but a repetition of Günther ('Introduction to the Study of Fishes', 1880, p. 363, and from which Laufer probably got his information), who states that this is the length mentioned by Basilewsky.

Five pages away from his *Acipenser mantschuricus* and under the heading 'Pisces Squamis Denudati', Basilewsky briefly describes the fish known to us as *Psephurus gladius* without giving it any scientific name. He says that this nameless fish (*'Acipenseri affinis'*), with an acutely pointed beak almost as long as the body, is found in the deeper reaches of the 'yellow river' (*Chuan che*) and in other Mongolian and Manchurian rivers. Then he adds, set off by itself, this brief statement:—'Longit. 10-20 ped.'

The European, who seems to have seen and first handled a large Sword-billed Sturgeon, was Dr. P. D. Handiside. In 1873 he exhibited before the Royal Society of Edinburgh, various small specimens and 'three pieces of an adult fish that measured fully 9 feet long'. He reported further that Mr. H. G. Hollingsworth, residing at Kiu-Kiang on the same river, had seen one measuring 15 feet and weighing 133 lbs. This small weight, however, seems entirely too little for the great length of even such a slender fish.

Of the habits of the Swordbill, we know little. The general body form, the underhung mouth and the strongly heterocercal tail give it a decidedly shark-like appearance. But the long pointed bill, very like that of a swordfish, is most noticeable, and every one wishes to know its use. The sturgeon lives in the heavily mud-laden rivers of China (the 'yellow river' for one), and in such water this fish with its very small eyes could hardly discern its food. So every one conjectures that the fish uses this long snout to stir up the bottom and rout or scare out the fishes and crustaceans on which it is believed to feed. This is confirmed by Handiside, who reported that this snout is thin at the margin but thick and keeled in the centre (see illustration). He further states that in the young specimens it is sharp at the point but it afterwards gets blunted and rounded off by digging in the silt of the river bottom. The eyes of the fish are of very small size and it is supposed that the sensitiveness of the spatula compensates for the lack of larger and better eyes.

Returning to the matter of size, Ping (1931) may be quoted that he procured in a fish market the head of a large specimen taken in the Yangtze. This head measured about 1.5 m. (59 in.) long and must have come from a fish about 150 in. (at least 12 ft.) long. Then he goes on to add that a mature fish may reach 7 m. (22 ft.) in length.

The last witness is Commander Rogers of H.M.S. *Aphis*. In the China Journal for 1935, he tells of the capture of a large specimen at Kiukiang on the Yangtze. The overall length of this fish was 9 ft. 9 in. The length of the sword, which had a rounded point was 3 ft. from tip to crest of forehead. The greatest girth of the fish (over the gills) was 40 in., the vertical gape was 9 in., and the width of the mouth 11 in. The fish weighed 180 lbs. The contrast of even this weight to the considerable length emphasizes the slender form of this species. A like-sized specimen of almost any other equally long sturgeon would have weighed two or three times as much. 'The fish was dissected and two large stones were found in its stomach.' The article by Rogers is illustrated by several cuts from photographs. None of the figures is distinct, and this is especially true of that of the whole fish. There is a heavy shadow below the head and bill, and the general background is of the same tone as that of the fish's body. However, using an enlarged photograph of head and sword, my skilful artist has cut and painted out everything but the anterior head and the bill with its blunt and rounded point (Text-fig. 4). When this is contrasted with the pointed bill shown in Fig. 1, pl. V, it is seen that the sword has surely lost inches of its tip—perhaps from having been used to dig in the river bottom for food. This is the only portrayal known to me of this anomaly, and pains have been taken to make an adequate reproduction of it.

THE COLOSSAL STURGEON OF THE AMUR RIVER.

I had expected to find in the great rivers of Siberia several sturgeons so large as to call for inclusion in this article. However, but one has been found—that whose habitat is in the Amur River. Most sturgeons spend part of their lives in salt water. Berg, the great authority on the freshwater fishes of the U.R.S.S., lists no large sturgeons in the north-flowing rivers of Siberia. This may be due to the fact that the mouths of these rivers, being north of the Arctic Circle, thaw late and freeze early, thus much restricting access to the Arctic Ocean.

The Kaluga, **Huso dauricus** of the Amur River.

The Amur River Sturgeon has been long known. In 1772, J. G. Georgi travelled through Dauria, that part of Siberia reaching south-east of Lake Baikal to the Chinese border. In his book of travels published in 1775, Georgi described this fine sturgeon under the name 'Kalluga, *Acipenser dauricus*'—the Daurian sturgeon. His specimen was only '6 Fuss, 4 Zoll', long. Our earliest knowledge of the great size attained by the Amur sturgeon comes from V. K. Soldatov (1915, p. 221). His largest specimen was 418 cm. (13 ft. 11 in.) long and weighed 541 kg. (1,190 lbs.). That this fish grows even larger is attested by Berg (1932, p. 43) who states that it reaches a length of 4 m. or more (13 ft.) and a weight for large fish running from 820 kg. (1,804 lbs.) to 1,140 kg. (2,058 lbs.). Truly *Huso dauricus* attains colossal size.

Fig. 2, plate IV, was drawn from a specimen only 122 cm. (48-8 in.) long, yet it portrays a large fish, especially heavily built forward. If only one could see in the flesh the specimen referred to by Berg as being over 13 ft. long and more than 2,500 lbs. in weight!

From the rivers of the continent of Asia, there have been given data for three huge catfishes—one the largest yet recorded; two colossal carps—one the largest now on record; and five giant sturgeons—one of these exceeding in size and weight even those of the Columbia River in the U.S.A. (Gudger, 1942). And, after considering all these facts, one wishes to know why there are in Asia record-breaking specimens of these three groups of freshwater fishes.

Indeed one might paraphrase Shakespeare and ask: 'Upon what food do these Asiatic Caesars feed that they do grow so great?' And it is a bit disconcerting to have to answer that we do not know. There must be a favourable combination of temperature and an optimum diet. This latter must contain all the main groups of foodstuffs necessary for these huge organisms—the proteins, fats, starches, inorganic salts, and vitamins. But, alas! of the food of these fishes there is total ignorance. The Pla Bük of the Mekong is said by Dr. Smith to scrape algae from the stones at the bottom of the river, and Duke states that their stomachs are never found to contain anything but stones. And also Capt. Rogers states that two large stones were found in the stomach of his Sword-billed Sturgeon. Algae, even in vast quantities, would seem to be an inadequate food to keep going the huge engine of this 12-foot catfish. And the stones, too large to be used to grind up any molluscan food, must simply serve as ballast. As to why these fishes reach such great sizes we must simply answer that—We do not know.

These negative answers, recall my oft-repeated statement, after handling more than 50,000 titles in 25 years' work on the 'Bibliography of Fishes', that—'We have barely scratched the surface.'

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IMMATURE STAGES OF INDIAN LEPIDOPTERA (*COSSIDAE, INDARBELIDAE*).

BY

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(*With a plate*)

The families *Indarbelidae* and *Cossidae* contain species the larvae of which attack the living stems of numerous valuable species of trees and are therefore of great economic importance. A means of identifying larvae is particularly desirable since rearing to the adult stage is difficult and also because nearly all requests for advice on control measures are accompanied by preserved larvae only.

In the following key to mature larvae, the *Hepialidae* (represented by *Phassus* spp.) are mentioned since their larvae superficially resemble those of *Indarbelidae* and have similar feeding habits, that is to say, they feed mainly on the soft external tissues of the stem under a camouflage of frass and silk, with a deeper tunnel for refuge. The *Cossidae* on the other hand feed internally on the sapwood.

In all three families the prespiracular setae on T1* are three in number, indicating affinity with the Microlepidoptera.

KEY TO FAMILIES.

1. The dorsal plate of T1 is continued downward on each side in front of spiracle and bears the 3 prespiracular setae. Crochets of ventral prolegs biserial, that is, with an outer ellipse of small crochets in addition to the main ellipse ... ... *Hepialidae.*
The 3 prespiracular setae of T1 isolated from the dorsal shield. Crochets uniserial, with no outer row. (2).
2. Head smooth, partly retracted into prothorax. Ocelli 1 to 4 in a nearly evenly spaced semicircle. Setae I and II not all on a common dorsal plate on anterior abdominal segments. (Pronotum asperate or not) ... ... *Cossidae.*
Head rugulose, not overlapped by prothorax. A wide gap between ocelli 2 and 3. The four setae I and II borne together on a dorsal plate. (Pronotum smooth) ... ... *Indarbelidae.*

Larvae of Cossidae.

Family characters.—Head rather small, partly embedded in prothoracic skin, nearly horizontal. Ocelli six on each side, the upper four in a semicircle, about equally spaced. Frons distinctly higher than wide. Adfrontal area rather narrow. Labrum with at most a trace of anterior emargination. Prothorax with three prespiracular setae which are separate from the well sclerotized dorsal shield. Mesothorax and metathorax with setae I and II one above the other, and with only one seta (VI) above the legs. Abdomen with seta I well anterior to, and more dorsal than seta II on anterior segments; setae IV and V approximate below spiracles. Head and body without secondary setae. With five pairs of short and stout prolegs, four ventral, one anal; crochets in an ellipse on ventral prolegs (transverse bands in Cossula, an American genus). Borers in living wood or in reeds (Phragmatoecia).

Seta IIIa anterior to spiracle. Small additional setae may be present near the anterior margins of the segments. The setae may be borne on small plates (pinacula) but these are isolated and not as extensive as in the Indarbelidae, except dorsally on prothorax, A9 and A10. The body is on the whole rather soft, less cylindrical than in Indarbelidae. Spiracles oval, small; apparently non-functional spiracles are present on T2 and T3.

Key to Genera.

1. Pronotum smooth. Seta III on A8 directly above the spiracle (Cossinae) ... ... *Cossus.*
Pronotum asperate posteriorly. Seta III on A8 either directly anterior to the spiracle or higher and slightly anterior (Zeuzerinae) ... ... (2).

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* The thoracic and abdominal segment are referred to as T1 to T3 and A1 to A10 respectively.

2. The asperities on pronotum coarse and prominent, especially in the anterior rows. Crochets biordinal or triordinal ... ... (3).

Pronotal asperities small, more granular, but there is an anterior row of four widely spaced transverse ridges, which, although fairly large are only slightly raised. Crochets uniordinal ... ... *Azygophleps.*

3. Not more than the posterior third of pronotum is asperate. Spiracle of A8 at least 1.5 times as large as that of A7, which is distinctly larger than that of A6. *Zeuzera.*

One half, or nearly half the pronotum is asperate. Spiracle of A8 less than 1.5 times as large as spiracle A7 which is subequal to spiracle A6 in mature larvae *Xyleutes.*

Cossus F.

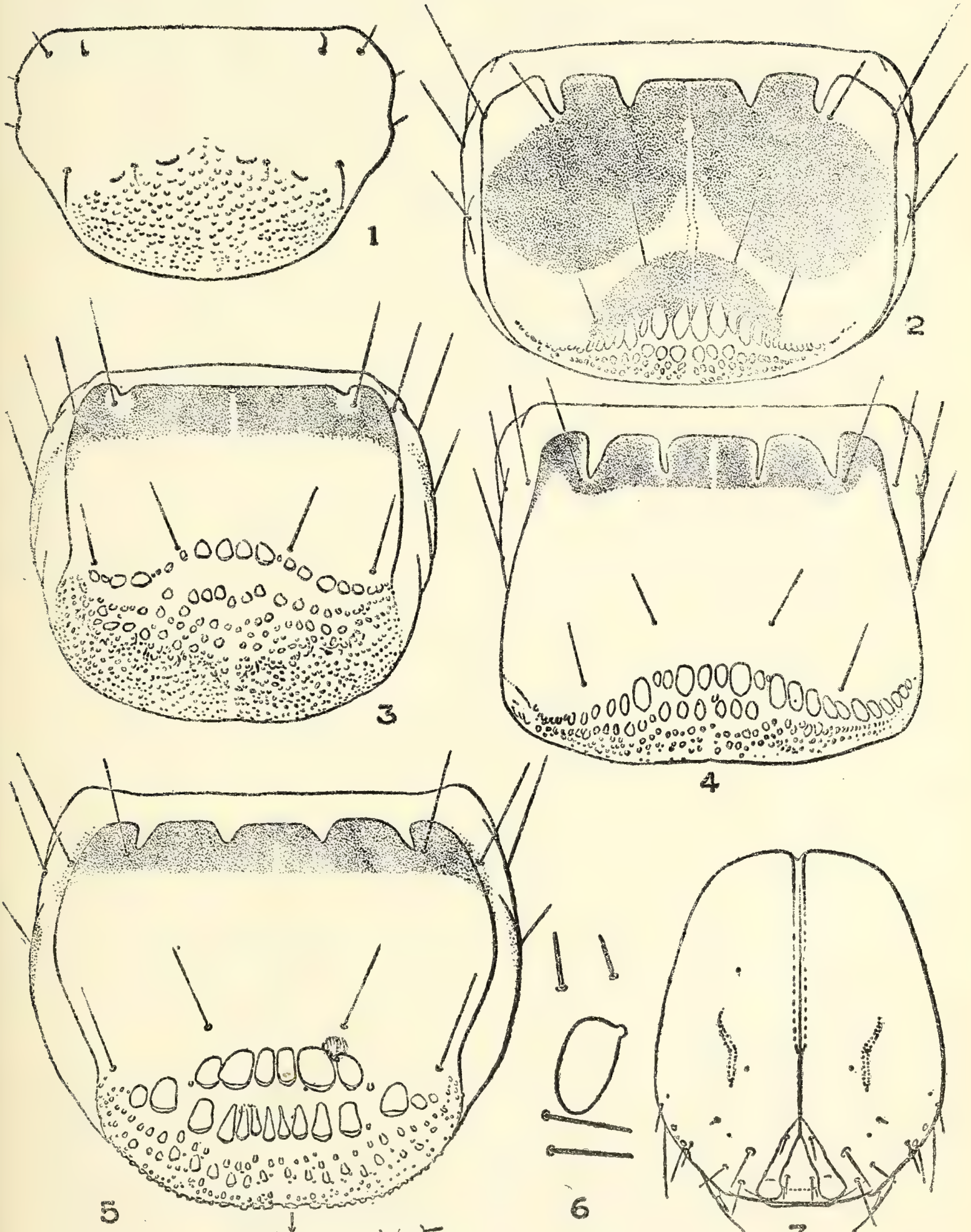
Larval characters.—Head slightly wider than long, with a deep posterior emargination (visible in dorsal view) which is continued anteriorly as a deep groove to not far from the middle of the head. The adfrontal sutures meet the apex of this groove. The frons nearly one-third as long as the head, and longer than the distance between its apex and the posterior groove. The prothoracic plate smooth, transverse, its lateral margins horizontal and near spiracles. Seta III of A8 above the spiracle. Setae II of A9 closer together than Setae I and also closer than Setae II of the preceding segments. Spiracle of A8 not enlarged, at the same level as the preceding spiracles. Crochets biordinal (or partly triordinal) in complete ellipse on ventral prolegs.

Cossus cadambae Moore has the head pale brown, pronotum testaceous, the setae not borne on pigmented plates. The spiracles large. The crochets triordinal in part. Three larvae, about 40 mm. long from *Tectona grandis,* Travancore.

Cossus acronyctoides Moore resembles the former except that the spiracles are very small. One larva, length 25 mm., from *Tamarix articulata,* Punjab.

Azygophleps scalaris F.

Larva (fig. 1).—Head about as wide as long, the posterior emargination rather narrow and about one-third length of head. Frons nearly one-third length of head, convex. Adfrontal sutures not quite reaching apex of posterior sinus. Prothoracic shield with a little more than the posterior half asperate; the asperities small, granular, irregularly arranged and more or less equal in size except for a posterior group of smaller asperities; anterior to this convex patch is a widely spaced row of four large, but weakly raised, transverse carinae. Spiracles large; that of A8 slightly larger than that of A7 and above the level of the preceding spiracles. Crochets of ventral prolegs uniordinal, in an ellipse. Seta III of A8 anterior to spiracle but well above it. Body setae inconspicuous. Some of the middle body segments somewhat raised dorsally forming weak 'ambulatory ampullae'. Length about 28 mm.



J. C. M. Gardner—Larvae of Cossidae.

For explanation see end of article.

Described from two larvae lent by the Imperial Agricultural Entomologist, New Delhi: one from stem of *Sesbania grandiflora*, Madras; the other from *Sesbania* sp., Orissa.

The larva is figured by Fletcher, 1918, *Rep. Imperial Entomologist,* pl. 16, fig. 2.

Phragmatoecia castaneae Hubn.

I have not seen larvae of this species which also occurs in Europe as a borer of reeds. The pronotum is asperate (Buckler), the last pair of spiracles enlarged and more dorsally placed and the crochets uniordinal and in a complete ellipse (Fracker).

Zeuzera latreille

Larval characters (figs. 2, 4, 6, 7).—Head much larger than wide, somewhat narrowly rounded posteriorly with at most a shallow emargination visible from above. Frons very small, about one-sixth as long as the head. Adfrons extending a short way beyond frons and distant from attachment of prothorax. Prothoracic shield strong, the lateral margins well above spiracles; not more than the posterior third asperate; the asperities in middle of anterior row coarse, longer than wide. A9 with a transverse plate bearing the dorsal setae. The other body setae on more or less circular isolated plates. Seta III of A8 anterior to the spiracle. Spiracle of A8 one and a half times or more larger than that of A7 and at a higher level; spiracle A7 larger than spiracle A6. Crochets biordinal (or triordinal in part), in a complete ellipse.

The elongate oval head has some resemblance to certain larvae of Lamiinae. However the figure of *Z. pyrina* from Europe, given by Frackler (1915, fig. 72) shows a transverse head with a strong posterior emargination which suggests that that species may not be really congeneric with Indian species of *Zeuzera*.

KEY TO SPECIES.

1.	The inner two of the four middle asperities of the anterior row on pronotum distinctly smaller than the other two	(2).
	The four middle asperities of the anterior row all of about the same size	*Z. coffeae.*
2.	The posterior spiracle with a small lip or angulation on the upper margin	*Z. multistrigata.*
	Peritreme of posterior spiracle even, without a lip.	*Z. indica.*

Zeuzera coffeae Nietner (figs. 2, 6, 7).—Head mostly testaceous; pronotum with dark brown anterior patches and dark asperities posteriorly, otherwise testaceous; body pink, the dorsal plates of A9, A10 pale brown. The asperities on pronotum as in figure 2, an antero-median row of four, large and equal and a small one on each side, continued laterally where they become minute; a second row of six moderate asperities; the remainder very small. The last posterior spiracle has a distinct lip dorsally (fig. 6). Length about 40 mm. The larva attacks numerous living trees, including *Tectona grandis* and *Santalum album* and is a pest on tea and coffee.

Z. multistrigata Moore (fig. 4).—The anterior row of asperities continued laterally and slightly backwards as in *coffeae*, but the middle two teeth are much smaller than the two on either side. The setal plates more deeply pigmented than in *coffeae*. The posterior spiracle with a lip or angulation of upper margin. Length about 65 mm. In small larvae (up to 17 mm.) the body is dark red, the head pronotum and dorsal plates on A9 and A10 black. In larger larvae these parts are smoky testaceous. Described from larvae extracted from *Cryptomeria japonica*, Darjeeling (J.C.M.G., 1923). These larvae, and those of Hepialids, were doing considerable damage in young plantations. Larvae sent me by the Entomologist, Fruit Research Station, Chaubattia, from apple trees, are identical.

Z. indica H. Schaffer.—The anterior row of asperities on pronotum very much as in *multistrigata* (two small in the middle, between two larger ones, and then a small one on each side) but the middle ones are rather more out of line with (more anterior than) the lateral row. The tergal plates and setal plates brownish. The posterior spiracle with no lip. Length about 60 mm.

Described from one larva from *Litsea polyantha*, Dehra Dun; moths were reared and later identified by Mr. G. E. Bryant. Another larva taken from the root of *Miliusa velutina*, Bhamo, Burma, appears to be identical; however, I have no record of the moth of this species from Burma.

Xyleutes Hubner.

Larval characters.—Very much as in *Zeuzera*, but the asperate patch on pronotum more extensive, covering distinctly more than the posterior third; the coarse anterior asperities more transverse. The head longer than wide, narrowed behind the middle; with a narrow posterior cleft which is almost closed in *persona*. Seta III of A8 anterior to spiracle and not above its level. Spiracle of A8 about 1.3 times larger than that of A7 which is subequal to that of A6. Mature larvae larger than *Zeuzera*. Borers in living wood. In small larvae (length about 25 mm.) the spiracle of A8 is much larger than that of A7 and is actually nearly as large as in the mature larva.

Xyleutes ceramica Walker is the notorious Beehole Borer of teak in Burma and the larval instars have been described in some detail by Beeson (1921). The head moderately elongate, the frons about one-third as long; the posterior margin with a narrow posterior cleft and groove. The pronotal asperities (fig. 3) extend to the middle of the shield, as far as the posterior paramedian setae; the posterior asperities small, more granular, numerous, the last row not widened. Setae I on A9 well anterior to setae II and only slightly more separated. The posterior spiracle larger than that of A7 and above its level; the peritreme evenly oval with no 'lip'. Setae of middle segments on at most very small plates. Length up to 62 mm.

Xyleutes leuconota Walker differs from *ceramica* as follows: Frons about one-fourth as long as head, which is more elongate, the posterior cleft of head narrower. The patch of asperities on pronotum (fig. 5) reaching neither the middle of pronotum nor the posterior paramedian setae; the posterior small asperities less numerous, the last row slightly enlarged, flattened. Setae I on A9 only slightly anterior to setae II and distinctly more widely separated. The posterior spiracle with a shallow 'lip' on posterior dorsal margin (when seen obliquely). Length about 85 mm. This species attacks species of *Cassia* and causes serious damage. Described from larvae ex *Cassia* sp. from Burma. It appears to be doubtful if *leuconota* is a synonym of *persona* le Guill.

INDARBELIDAE.

The generic name *Arbela,* Moore (1879) is preoccupied by *Arbela,* Stal (1865) in the Reduviidae. Fletcher (1922, *Entomologist,* 55, 231) renamed the genus *Indarbela.* The family name is therefore *Indarbelidae.* Dalla Torre and Strand (1923, in Wagner, Lep. Cat., 28: 3) overlooked Fletcher's remark and introduced the name *Lepidarbela* for the genus and later refer to the family as Lepidarbelidae (1928, *Lep. Cat.* Junk, pars. 28).

I have seen larvae of only one species of this family.

Indarbela quadrinotata Walker.

Larva.—Head as wide as thorax, transversely subcircular, not retracted into thorax, the frontal surface nearly vertical, rugulose with a groove, bordered by carinae, running back from each antenna. Frons small, very slightly higher than wide, its apex near the middle of the head. Adfrons wide, the sutures meeting the coronal suture well before the posterior sinus. Ocelli six, a wide gap between 2 and 3. Labrum transverse, not emarginate. Prothorax with a transverse smooth shield and each following tergum with a distinct shield which bears the four setae I and II; the three prespiracular setae of T1 borne on a small separate plate. T2 and T3 with I and II approximate, one above the other, and with only one seta (VI) above the leg. There are no secondary setae. On the abdomen setae II widely separated, setae I only slightly closer to one another than, and not far anterior to, setae II; seta III above the spiracle on an elongate plate; setae IV and V approximate below spiracle on a small plate behind which is another plate without a seta; VI on an elongate plate; VII (on base of proleg or at that level) with three setae. Legs normal. Prolegs, one anal and four ventral pairs. Crochets of ventral prolegs uniserial in an incomplete ellipse which is very weak externally and more distinctly broken internally where the anterior band overlaps the posterior band; the crochets of the anterior band are stronger than those of the posterior band and four alternating sizes of crochet are recognizable; crochets of anal prolegs in a continuous transverse band. Spiracles small, oval, those of A1 and A8 enlarged and all at the same level.

The head dark castaneous. Body white with the numerous plates usually infuscated. Setae mostly quite long. Body slender, subcylindrical, tapering slightly posteriorly. Length up to 50 mm.

The larva has numerous host trees and may cause serious damage. It feeds on bark under a camouflage of frass and silk and has an internal tunnel or retreat very much as in *Phassus* (Hepialidae) to which the larva has a superficial resemblance, although very different in important characters and closely related to the Cossidae.

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EXPLANATION OF PLATE.

Fig. 1, pronotum of *Azygophleps scalaris*; 2, same of *Zeuzera coffeae*; 3, same of *Xyleutes ceramica*; 4, same of *Zeuzera multistrigata*; 5, same of *Xyleutes leuconota*; 6, posterior spiracle of *Zeuzera coffeae*; 7, head of *Z. coffeae*.

NOTES ON THE GENUS *RUPPIA* (*RUPPIACEAE*).

BY

CHARLES McCANN, F.L.S.

(*With a plate*).

The genus *Ruppia* is represented by a single cosmopolitan species (*Willis*); it is the only genus in the family *Ruppiaceae*, order *Potamagetonales* (*Hutchinson*).

After a detailed examination of a large amount of living material in the field, and of plants kept in an aquarium, I am of opinion that *Ruppia* is sadly in need of a clearer definition than is to be found in most works dealing with it. *Ruppia* does not make a very satisfactory herbarium specimen. If the original description was based on such material it is not surprising to find ambiguous, and even erroneous, statements in literature, as some of the minute structures are distorted beyond recognition. Below I give Griffith's description from the *Notulae*, and a fuller description by myself based on living material.

Ruppia maritima Linn.

*Description.**—'Planta aquatica in massis intricatis, gracilis, fucoidea, dichotoma.

Folia cylindraceo-planiuscula e basi lilatata longe attenuata, acutato-cuspidata pallide viridescentia. Structura e canaliculis 2, initio septis transversis interruptis septo longitudinale centrale interposito.

Axillae, folia alia gignunt bina? vel una quorum interius junius in parte inferne membrana stipulacea involvitur.

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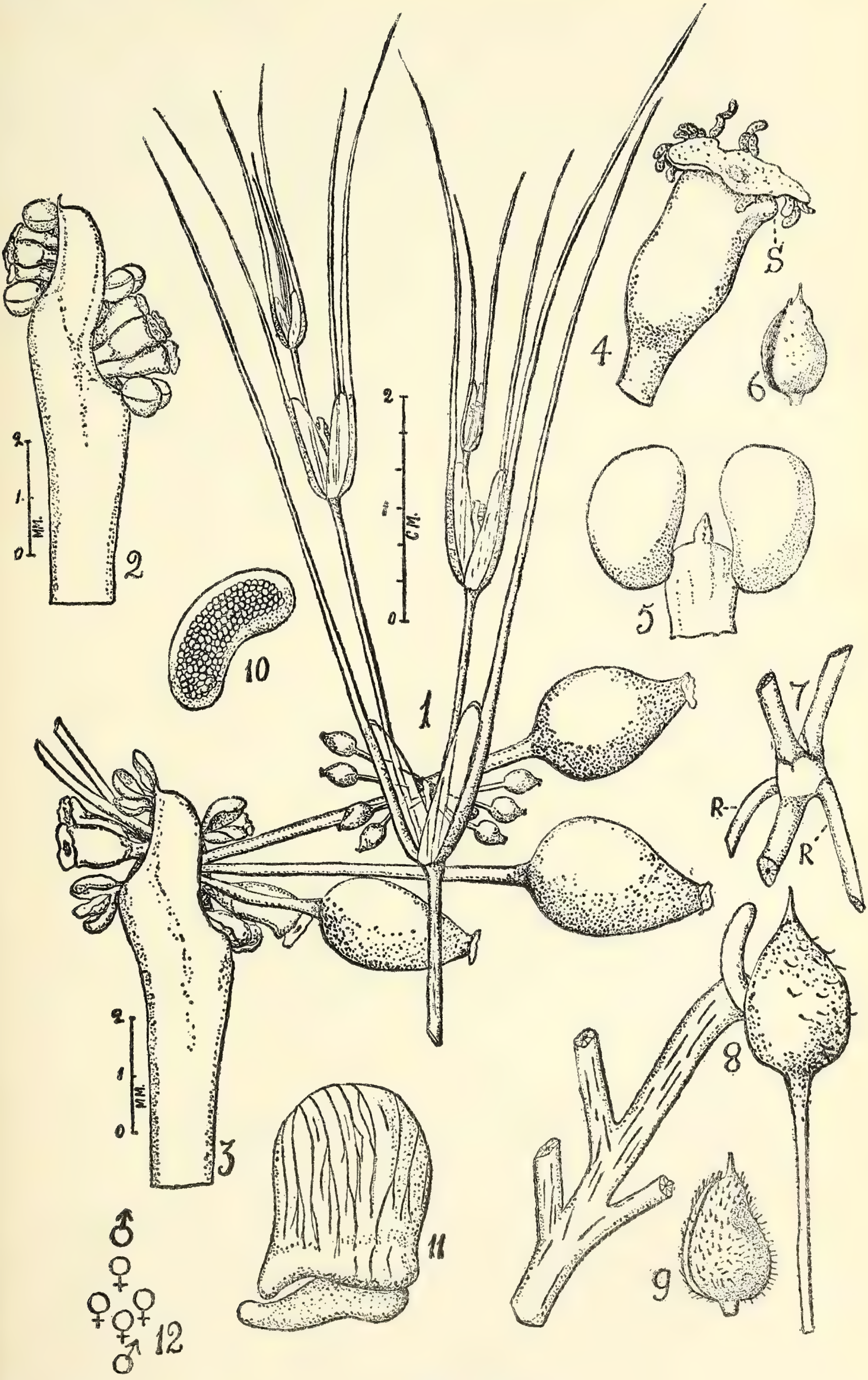
* This description I submitted to a friend, who is well versed in Latin, for favour of translation. He held up his hands in horror at the 'Latin' and politely suggested that I had copied it wrongly! I went back to the original to make sure, and found that the book was wrong and not I! *The Notulae*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Del. C. McCann

Ruppia maritima Linn.

For explanation see end of article.

Spadix terminalis e partibus dilatatus fol. 2 terminal. subopposita vix exserta, subclavata 2-4 linealis.

Spatha plana spathulata *structura vaginarum* apice pleurumque denticulata. Flores in spadici sessiles numero semper 2, inconspicui omnino nudi.

Stamina 4 in spadice saepius transverse sita, brunnescentis.

Antherae sessiles oblongi uniloculares rima centrali quoad axin: transversa dehiscentes cellulae fibrosae sub o.

Pollen singulari forma, magnum oblongum curvatum, subreniforme e vesiculo e plicato, e perforato translucido globulos majusculos (fovillam) includens, apicibus interdum constrictis.

Ovaria 4 subsessilis, cum antheris alternant, oblonga, glabra. Stylus nullus. Stigma discoid., magnum. Ovulum unicum hinc oblique gibbosum subsessile, foramen apicale, tegument cellulosa exterius laxum. Spad. pedunculus demum paullo elongatus rectus.

Capsula ovata in spicem pedicelli albi subclavati fere uncinalis; apice stigmati coronata parietes cellulosa. Pyrena tenuia, conforme, nigram osseam apice attenuata in corpore styliforme acuto stigmata attingens, epicarpium soulbile erectum, secus faceum internam sulca lanceolata notat.

Parietes ejus crassi sunt spongiosi, et cavitatibus parvis excavati.

Semen pendulum albumen: tegument externius laxum celluosum interius simili sel tenuius foramine laterali!

Embryo conforme carnosus, e radicula maxime crassissimus aspectu albuminis, obtusissimus, apicem geometricam seminis oblonga spectans. Cotyledone cylindraceus parvus, in basi radicis incumbens. Plumula inclusa, minima, in basis hujus, fissura minima e rumpens.' (*Griffith.*)

A submerged aquatic herb growing in brackish water forming dense masses of filiform, leafy, flaccid stems and branches, 15-75 cm. long. Roots 20-70 mm. long, filamentous, cylindric, covered with a dense growth of long root hairs, arising in opposite pairs at the nodes of the rhizome and lower branches. Stem a creeping rhizome, cylindric or subangular, dichotomously much branched; branches arising between scales (the remains of abortive leaf bases?) with 2 somewhat stout roots at each node, ascending; internodes 45-50 cm.; nodes slightly dilated. Leaves 70-90 mm., filiform, green, base with spathaceous wings (stipular?), opposite or nearly so; wings 12 mm. as wide as the leaf, hyaline, sheathing, tips rounded (of wings). Flowers minute, in 2 clusters of 4-6 (reduced to pistils and stamens). Peduncle 4-5 mm., elongating to 7 mm. in fruit, with two alternate pits containing the florets; often terminated by a mucronate appendage; peduncle subtended by a hyaline, linear bract about half its length, tip subacute or errose. Male flower represented by 2, one-celled anthers borne on an extremely short filament which ends in an appendage, and occasionally an abortive bud. There are 2 male florets in each cluster. Anthers ellipsoid or suborbicular, dehiscing through the centre. Pollen long-kidney-shaped, buoyant, pale yellow, smooth, exhibiting large granules within. Female florets 2-4 in each cluster, reduced to pistils, stipitate, stipe elongating from 25-30 mm., obovate-oblong, truncate, surmounted by a dense discoid, peltate stigmatic canopy; stigma minute, mammillate, to one side, tinged with light or deep pink. Ovule solitary. Fruit ovoid, obliquely ovoid, or subreniform achene, compressed, beaked; pericarp subcartilaginous, green, endocarp hard, black, bearing barbs and excrescences. Seed solitary, testa membraneous. (*McCann.*)

Field Observations.

Ruppia is a submerged, rhizomatous, much branched flaccid, aquatic plant growing in saline water. It forms dense growths, often covering large areas. When the tops of the branches reach the surface, and lie parallel with it, they

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are composed of a collection of Griffith's papers and were published posthumously, and therefore, Griffiths is not responsible for such 'Latin', but the compiler. However, I feel it is necessary to point out that it is much better to have a good English description rather than an unintelligible Latin one! If Latin *must* be used, the description should be submitted to someone fully conversant with the language.

are often fractured by the action of waves, and drift on the surface till stranded. Masses of detached pieces are washed ashore. The plants require a fairly still situation where there are no strong currents. The slender rhizome is much branched and is anchored to the substratum. Willis describes it as: 'A slender swimming pl. with the habit of Potamageton.' Both *Ruppia* and *Potamageton* (and so also, *Aponogeton*) are normally anchored in the mud of the habitat, and only break away from their moorings by some accident, such as the action of waves or of animals. In the case of *Ruppia*, detached fragments do not survive for long, but in the case of *Potamageton* such pieces float and survive for a considerable period. *Potamageton* produces submerged and floating leaves; *Ruppia* produces submerged leaves only, not capable of surviving the direct rays of the sun. Thus *Ruppia* cannot be called a 'swimming' plant. Another big difference between the two genera is that *Ruppia* produces flowers and fruits *under water,* whereas *Potamageton* produces its flowers and fruits *above* the surface.

Stem.—The stem is represented by a much branched slender rhizome which sends up many leafy shoots. The branching is dichotomous. At the nodes of the rhizome, and of the lower branches, appear two long roots bearing long and numerous root-hairs.

Leaves.—[1]T. Cooke describes the leaves as 'formed of two parallel tubes'. This statement puzzled me considerably until I was able to consult Griffith's work on the subject. The statement 'two parallel tubes' is an anotomical character referring to a cross section of the leaf, and should not have been placed among morphological characters in such a misleading manner. The leaves are filiform with stipular, hyaline wings at the base. There are two leaves at each node. In the axil of each leaf a new branch develops, thus giving rise to the dichotomous arrangement.

Flowers.—The most important point regarding *Ruppia* is to determine whether we are dealing with *two flowers* as described or with *two clusters of florets* on each peduncle. The following are extracts from authoritative works:—

(a) 'Each spike of 2 fls. not enclosed in the spathe at flowering time. The fl. has 2 sta. with small outgrowths from the connectives, and 4 cpls.' (*Willis.*)

(b) 'Flowers minute, in pairs, enclosed in a leaf-sheath.' (*Cooke.*)

(c) 'Flowers minute, bisexual, 2-6 together within the leaf-sheath, on a short peduncle which usually elongates generally after flowering; and is then straight or spirally twisted.' (*Hooker f.*)

After an examination of a large number of flowers in all stages of development, I am of opinion that in the case of *Ruppia* we are in reality dealing with an inflorescence composed of *two clusters* of florets and not *two flowers.*

My chief reasons for adopting this view are:—

(a) As the so-called separate carpels are each provided with a separate stigma each is capable of independent development, which is in reality the case.

(b) The difference in time of the development between the two pairs of 'carpels' points to a difference in the time of maturation and fertilization of the stigmas. We shall now deal with the details of the inflorescence in order, commencing with the peduncle.

Peduncle.—A narrow hyaline bract or sheath subtends the peduncle. On this subject the authorities write:

'On an ultimately elongating straight or spirally coiled peduncle (*Cooke*). Peduncles ¼-1 in. long, not spirally coiled.' (*Cooke*)

'Short peduncle which usually elongates greatly after flowering, and is then straight or spirally twisted.' (*Hk. f.*) 'Peduncle straight after flowering.' (*Hk. f.*) 'Fruiting peduncles 1-6 in.' (*Hooker f.*)

Both these authors are inconsistent in the same description and the student is immediately put in doubt! At times it appears that the term peduncle has been used indiscriminately for the peduncle proper, and the stipe.

According to my own observations, in no case do I find the peduncle to exceed 7 mm., whether in flower or in fruit. I have also failed to find one spirally twisted, the two alternate pits in which the florets are borne may give the twisted appearance. In this regard Trimen is correct in saying 'not spirally twisted'. At the top of the peduncle may be found a short appendage.

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[1] *Fl. Bombay Presidency*, Vol. 2 (1908), p. 839.

Flowers.—The number of florets in each hollow varies slightly, but the normal appears to be *two* males (stamens) and *four* pistils in each socket. It is the number of females in each cluster which varies; the males appear to be constant *Male floret*: The male floret is reduced to a single filament bearing two one-celled anthers. With regard to the anthers the authorities write:

'*Anthers* 2, sessile, opposite, 2-celled.' (Hk. f.)

'Stamens 2; anthers sessile, 2-celled.' (*Cooke*) The above statements are most confusing![*]

'On each filament there are two sessile, ellipsoid anthers which dehisce through the middle. The anthers are one-celled. The two halves remain gaping and the pollen leaves gradually and floats to the surface. The pollen is long-kidney-shaped, smooth, granular within, pale yellow. In each cluster there are two male florets one above, and the other below the female cluster. *Female floret*: The female flower is represented by the very shortly stalked pistil. The pistil is obovate-oblong, truncated, and surmounted by a somewhat fleshy peltate or discoid, stigma-like organ, which I propose to call the *stigmatic-canopy.* This organ has been referred to as the stigma itself in all works, but I cannot agree on this score. The stigma is in reality a minute mammilate structure to one side and just beneath the stigmatic-canopy. The pistil is a uniform green, like the leaves, and it is only the mammilate stigma which is tinged with pink or somewhat reddish hues. In dried material the student will experience difficulty in determining the stigma.

The stigmatic-canopy is a dense discoidal layer of tissue which is readily detached from the pistil. It is rounded elliptic, or sometimes irregular in outline. The centre is more thickened than the surrounding tissue and when it is detached exhibits a minute perforation corresponding to the beak of the achene; thus it forms an umbrella over the pistil. This curious organ puzzled me for a considerable time and after much observation I finally arrived at the conclusion that it is a pollen trap. The pollen, as it rises through the water, is caught by it. The pollen adheres to the margin, and under the margin of the canopy; gradually it drifts round towards the stigma, thus effecting pollination. The remains of the canopy persist in the mature fruit, but in a very shrivalled and reduced state.

Fruit.—After fertilization the stipe begins to lengthen. Its length may vary from 15 to 30 mm. The stipe appears to me to be a prolongation of the hard endocarp as in the case of the beak. It is thus not a true pedicil. The pericarp is subcoriaceous. Soon after the achene leaves the parent plant, the pericarp decomposes leaving the hard, black endocarp covered with barb-like excrescences over its whole surface and the two 'spinal' processes at either pole. The stipe is not long-lived, and in course of time the achene loses its beak and the surface becomes somewhat smooth. When mature the fruit appear like two umbellate clusters on either side of the peduncle. On maturity, the fruit detach and sink to the bottom. On dessication the stipe coils in various ways and thus forms a sort of prehensile tail to the achene for a time. I shall refer to this point once more under the heading of seed dispersal.

The shape of the achene varies slightly from ovoid, obliquely-ovoid to subreniform, somewhat compressed. The seed is protected by a submembraneous testa. The embryo is macropodal.

Germination.—The achene splits along one margin for almost its full length. The endocarp is almost persistently attached to the plants. Germination appears to be rapid and soon after maturation of seed: this continues till the salinity of the water is too great for the well-being of the plant.

Seed dispersal.—There appears to be little doubt that aquatic birds are largely responsible for the dispersal of *Ruppia.* The carriage may be external or internal. The barb-like excrescences of the achene enables it to be carried in the plumage of birds; the small size enables it to be attached to birds in clots of earth. The wind would only play a part when the seeds are exposed on the surface, or when mixed in other debre which is easily carried by wind. A large number of seeds may escape the digestive tract of some birds, but I doubt if the seeds would survive the gastric juices of healthy birds, and of birds whose regular food is *Ruppia* seed. In an article on the breeding of Flamingoes in the Great Rann of Cutch,[1] I pointed out that the young of the birds that bred in the Rann depended entirely on *Ruppia* seeds for their existence. It was only the vast amount of seed that was produced that made breeding possible. Most of the birds of prey which feed on aquatic birds are winter visitors to India, like the aquatic birds themselves. Such birds of prey assist indirectly in the dispersal of the seed. *Ruppia* is at its height when the visitors are here. The stomach contents of the prey are usually discarded, and in this way the birds of prey assist in dispersal.

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[*] Griffith described the number of anthers in each floret, and the number of cells in each anther correctly, and my own observations agree with his. It is difficult to see how both Hooker f. and Cooke overlooked these points.

The following are extracts from Ridley's work on seed dispersal :—

'It appears that when the peduncle is detached the fruits become subject to the action of the wind and wave, and are washed ashore, probably mixed with green algae, which, together with the decaying outer layer of the pericarp, causes a certain amount of adhesiveness, so that when rolled along the shore by the wind they sausage-like or round masses, the fruits being so compacted together that it is difficult to extract single specimens.' (From a note by T. Kirk in Herbarium Kew, *Ridley*, p. 36.)

Kirk evidently refers here to the stipe as the peduncle: as the peduncle does not become detached, but as the masses referred to may be composed of green algae and fragments washed ashore, there is the possibility that the peduncle itself may be present. The barb-like processes on the achenes and the 'prehensilt' tail could certainly enable the seeds and the algae to form masses. So far I have not observed this, but there is plenty of algae growing in the same habitat.

'The fruits of this plant float but a day (Praeger), but fragments of the plant bearing fruit certainly float longer than this. It is a world-wide plant apparently mainly dispersed by attachment to water-fowl.' (*Ridley*, p. 233.)

According to my own observation mature fruit sink in water as soon as they are detached from the parent plant.

('. . . and I select merely those which could readily pass through it with the seeds unharmed) : . . . *Ruppia maritima*, . . . ' (*Ridley*, p. 400.)

The seeds referred to were obtained from the stomach of the Mallard (*Anas platyrrhyncha*). As I have already mentioned, I doubt if seeds would pass unharmed through the alimentary canal of a bird which depends on *Ruppia* for its food.

Pollination.—Referring to the subject of pollination Willis states: 'The fls. are borne just at the surface of the water where fert. occurs by floating pollen.' This statement is not wholly correct and needs explanation. That fertilization may, and probably does, take place near or at the surface, between flowers on floating fragments, and floating pollen, cannot be ruled out, but as the fragments themselves soon perish there is little chance of such fragments maturing freshly fertilized ovules. However, according to my own observations, the normal method of pollination is *under water*, otherwise it would be difficult to explain the development and maturation of fruit deep below the surface.

As I have already explained, there are four anthers in each cluster, two above and two below the female cluster. The anthers dehisce first and shed their pollen little by little. The pollen drifts upwards and on its way is arrested by the stigmatic-canopy. The pollen adheres to the margin of the canopy and under it; gradually it drifts round to the stigma when fertilization takes place. The pollen grains may be seen singly or in sausage-like strings clinging to the canopy. So far I have not witnessed any pollen adherent to the upper surface of the canopy.

Of the normally four female florets, the 'upper' two generally appear to be fertilized before the 'lower' two, and develop into fruit. They are closely followed by the lower ones. The stipes elongate so rapidly that there does not appear to be a great interval, for the stipes are soon equal in length.

Distribution.—'*Ruppia maritima* is another world-wide aquatic found on the coasts of Europe, Asia (India, China, Formosa), Malay Peninsula, Phillipines, South Africa, Socotra, Canaries, Madeira, Mauritius, Australia, New Caledonia,

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[1] *J.B.N.H.S.*, Vol. 41 (1939), p. 12.

New Zealand, all America and West Indies, including Bermudas, probably mainly dispersed by ducks.' (*Ridley*, p. 694.)

As Griffith's work is not readily available to most students, I reprint his observations from the *Notulae* :—

'I have not met with specimens in a state sufficient to warrant me in forming any conclusion as to the fact of the nucleus changing its position or not.

'Ruppia appears to me to be a cellular plant, the stem consists of a central bundle of longitudinal tissue, and the space between this and the circumference is occupied by air cells of the usual formation, I have not been able to trace the existence of any vessels.

'The division of the axis is dichotonous, an arrangement which pervades throughout the lower orders of vegetables, and which would seem to mark this as a transition from flowering to flowerless plants.

'The leaves consist of two tubes, separated by a septum which occupies the centre, a similar structure exists in other aquatic plants.

'The spadix is always terminal and the two uppermost leaves are so approximated as to appear opposite. The axilla of each leaf bears a bud consisting generally of two leaves, but occasionally of a branch of the axis.

'In this last case, it is furnished with a sheath, in the former, the inner leaf is always similarly provided. The spatha is of a similar structure and possibly of a similar origin, it never even in very young stages protects the spadix, although its margins are curved in this direction. Although not evidently belonging to the peduncle of the spatha, yet as it always exists, and is never folded round the leaf or the ramifications of the axis, I am disposed to consider it as being a true spatha.

'The flowers are of very similar conformation, consisting of 4 anthers, and 4 alternating ovaries, the disposition is always alternate, and the number limited to two. In the pollen I have not yet ascertained tht existence of a fold or pore, or an indication of the existence of an inner membrane. In the appearance of this structure and the large size of the contained granules, it agrees entirely with Naias and Ceratophyllum, and with some very widely different dicotyledonous plants, such as Sarcocodon, all of which are immediately allied with Rafflesiaceae.

'I have seen that the radicle presents a marked deviation from its usual relations with the coats of the ovulum. Before impregnation, which appears to be of very general occurrence, the foramen of the coats of the ovulum is situated at the apex of the seed, and to this the apex of the nucleus, strictly corresponds. In the mature the foramen will be found somewhat about the centre of the outer face of the seed on which it presents a mammilar appearance.

'The change in the direction of this occurs very rapidly, and at the time when it is quite completed, the radicle will be found developed at the geometrical apex.

'Whether this change is accompanied by the usual corresponding change in the nucleus I cannot state from demonstration, for the nucleus presents none of those indications by which its apex is in most other ovula or seeds so easily recognised, on the contrary, its surface is homogeneous and equal throughout. But it may be inferred that it does not; for although one instance has been adduced in which the radicle does not correspond to the apex of the nucleus, for even in cases where it is formed externally to the nucleus, it agrees in the direction with the body.

'The ovulum has, I think, the ordinary structure differing only in the very large size of the cell from which the embryo is developed, and to which, under some modification or other, it is always attached. In supposing this globular body to be the footstalk of the embryo, I am guided entirely by analogy, for I have not been able to separate the embryonary sac, which I consider to occupy closely the more transparent part of the young seed. Of such extreme tenuity and intimate adherence, examples are by no means wanting, but it would be contrary to all analogy to assume that the embryo is formed outside the embryonary sac. The direction of the young radicle does not appear to be otherwise constant, that it is not always in the axis of the ovulum, but is generally inclined to one side or the other. I thought at one time that it was generally inclined towards the foramen, but I am not disposed to say that it is constantly so, indeed the cavity of the embryonary sac is so large, and its contents so aqueous that very slight pressure necessarily consequent on dissection may cause a change.

'The cotyledon is not tardy in making its appearance, its direction is oblique with regard to the radicle, and it assumes its subsequent recumbent position owing to the resistance it meets on its reaching the upper part of the cavity of the sac; and when the embryo is half developed, the existence of the plumule may likewise be ascertained.

'The radicle always maintains its original direction which is that of the ovulum before impregnation. That part of its base which is contiguous to the foramen is more transparent than the rest, and is somewhat conical and this appears to be considered by Hooker as the radicle.

'Examination of germinating specimens can only help to clear up which part of the immense radicle first germinates. All analogy would teach us that its true apex is the first part that undergoes any change. And the resistance of the drupe being overcome, that of the coats of the seed is so small, that there is but little ground for assuming than any extraordinary change in this respect would occur. The change in the direction of part of the seed is in accordance with the structure of the order ? Ruppia is, I believe, a new addition to the Flora of India, and it is an additional instance of the fact that the flora even of Calcutta, is by no means exhausted.

'Of the fourteen genera of this family enumerated in Lindley's Introduction, India possesses Caullinia, Naias, Potamageton, Zanichellia and Ruppia. To these are to be added Ceratophyllum, Potamageton is the most perfect in the number of parts, and of species.

'It belongs to an order in which the extremes of geographical distribution occurs. Whether this depends on the habits of the plants, or on their low organisation (shown by their comparatively small number of species), remains to be shewn. It is a curious thing that some of the species are decidedly marine plants, thus forming an obvious approach to algae, as Thalassia marina, Zostera, Cymodora Posidoniei.' (*Griffith.*)

Illustrations.—Though the Latin of the *Notulae* is faulty, Griffith leaves us in no doubt as to the plant and characters observed by him—his plates cclvii to cclix are on the whole very good.

EXPLANATION OF PLATE.

1. Portion of plant. 2 & 3. Peduncle and florets. 4. Pistil. 5. Stamen. 6. Dehesed achne (shell). 7. Node with roots. 8. Rhizome with shell of achne attached. 9. Achne after decomposition of pericarp. 11. Embryo. 12. Disposition of florets. R = Root. S = Stigma.

THE BIOLOGY AND ANATOMY OF *SCIRPUS GROSSUS* LINN. *FIL.*

BY

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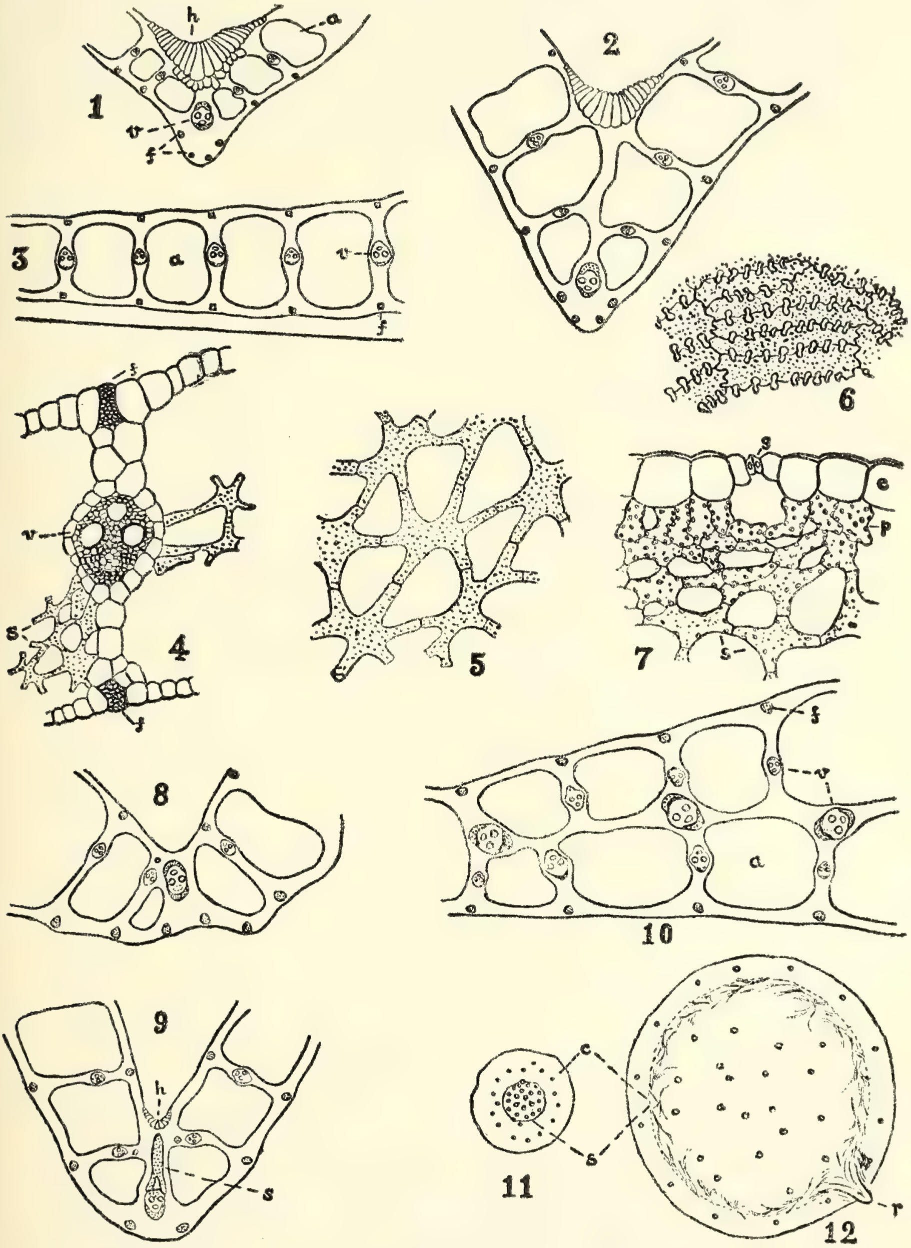
St. Xavier's College, Bombay

(*With a plate*)

Synonymy.—Cooke (7) describes *Scirpus grossus* [Linn. fil. Suppl. (1781) 104] and *S. Kysoor* [Roxb. Hort. Beng. (1814) 6] as distinct individuals, thus restoring Roxburg's species. Sedgwick (18) follows Cooke and treats the two plants separately though he says: 'I am unable to separate satisfactorily the available material.' Other authors like Clarke in Hooker's Flora (14) and Woodrow (21) regard *S. Kysoor* Roxb. as a variety of *S. grossus* Linn. *fil.* Blatter (4) remarks: 'We are quite unable to distinguish between *S. grossus* and *S. Kysoor* which we think may only be a form. We do not feel justified in keeping the two apart and therefore unite them under the older name of *Scirpus grossus* Linn. f.' Haines (13) and Index Kewensis follow the same synonymy, viz. *S. grossus* Linn. *fil.* syn. *S. Kysoor* Roxb.

Indian names.—Kaseruka (*Sanskrit*); Kachera (*Bombay*); Kasara (*Marathi*); Kasuru, Kesur (*Hindi*); Kaseru (*Urdu*); Kasura, Kesor, Kesur (*Bengali*).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D. P. Mullan—**Scirpus grossus** Linn. *Fil.*

For explanation see end of article.

Uses.—The plant is sometimes cultivated for the tubers which are eaten in many parts of India as an article of food. According to Haines (13) the stems are often used for coarse matting. The leaves and aerial stems are often used as fodder. According to Dymock (10), Watt (20), and Kirtikar (15): the tuber has astringent properties and is given in indigenous medicine in diarrhoea and vomiting. It is chewed for the purpose of checking sickness or to remove the taste of medicine. According to Caius (5): 'Yunanists describe the root as slightly sweet, cooling, laxative, tonic to the liver, good against burning sensations, vomiting, diarrhoea and gonorrhoea.'

DESCRIPTION

Scirpus grossus Linn. *fil.* syn. *S. Kysoor* Roxb. is a large marsh sedge, growing in beds of rivers, tanks, etc. It grows more or less throughout India and is very common in the Konkan, principally Salsette. The lower part of the plant lives in a foot or more of water or in soaking soil. The rootstock bears several stolons which run underground for a short distance and frequently bear, at the ends, hard, globose, dark-coloured tubers clothed with matted fibres. The flowering stem is erect, 4-6 ft. high, triquetrous with sharp angles which are hispid in the upper part. Several long leaves radiate from the base of the flowering axis. The leaves are linear, acuminate, with the margins and keel minutely serrulate in the upper part. The flowers are borne in terminal umbels of brown spikelets. Flowering and fruiting is towards the end of the monsoon, i.e., mostly from September to November in Salsette.

During the period of vegetation, the plant sends out long stolons which creep underground for some distance; ultimately the growing apex turns upward, and produces a new plant. Thus the stolons are propagating organs and are a means of vegetative multiplication of the plant, since one individual may give rise to several stolons. Under favourable conditions, *i.e.* if the pond remains full of water, the stolons produce new plants at their extremities and thus continue to live throughout the year. But if the pond begins to dry up, as is usually the case during the dry season, the stolons swell at the ends and produce tubers. With the drying of the pond, the plants die down to the surface of the soil but the tubers perennate, remaining dormant throughout the dry season and sprout in the next monsoon. The tuber on sprouting usually produces a new stolon which runs to a short distance and gives rise to a new plant at its apex. At times, the new plant arises directly from the top of the tuber. Thus the tubers are of the nature of hibernating organs and are a means of tiding over dry seasons unfavourable to vegetative growth.

ANATOMY

The anatomy of the Cyperaceae, including some species of *Scirpus*, is investigated by Duval-Jouve (8), de Bary (2), Plowman (16), Haberlandt (12), Sabnis (17), Arber (1) and others.

Leaf-Blade.—The leaf consists of a linear leaf-blade and a sheathing leaf-base which merges in a joint with the leaf-blade. In surface view, the epidermal cells of the leaf are elongate-rectangular in shape with sinuous walls. Longitudinal rows of stomata, typical of Grasses and Sedges, are more numerous on the lower surface on the basal part of the leaf, while on the upper part they are equally distributed on both surfaces. In the furrow of the midrib region, the upper epidermal cells are distinguished by being deeper than the rest of the epidermal cell. These cells are thin-walled, elongated at right angles to the surface, narrowed above and wide below (Figs. 1, 2). Such cells are characteristic of many Grasses and Sedges and are described by: Duval-Jouve (9), Warming (19), Haberlandt (12) and others as hinge-cells, motor-cells, articulation tissue, etc. Apart from functioning as water-reservoirs, according to Duval-Jouve (9), the hinge-cells play some part in the upward folding or rolling of the leaf by the decrease in their turgor during dry weather, thus reducing the transpiring surface.

The internal structure of the leaf-blade is divided into a single row of compartments by narrow girders or bridges of tissue arranged parallel to one another and at right angles to the surface of the leaf (Fig. 3). The girders are composed of clear cells and alternate with air-passages. The upper and lower flanges of the girder are composed of sub-epidermal fibrous strands, while the web consists of a vascular bundle in the middle, enclosed in a sheath of large, clear cells (Fig. 4). Thus the mechanical tissue of the leaf is composed of isolated I-girders.

The veins or vascular bundles are placed in the bridges, smaller bundles alternating between the larger ones. The bundles are all of the normal collateral type. The air-passages are placed between the girders and are one of the marked anatomical characters of aquatic and marsh plants. As shown in various plants by Goebel (11), Warming (19), Haberlandt (12) and others, the air-passages serve mainly for aeration. The air-passages are stiffened by a stellate parenchyma which fills the air-passage (Fig. 4). The stellate tissue thus performs a mechanical function by preventing the collapse of the air-passage and also acts as an aerenchyma. The stellate parenchyma is composed of cells with a small central portion of long arms by which the different cells are joined together, leaving large lacunae in between (Fig. 5). The outer cells hold a few chloroplasts, while the inner stellate cells are clear. Towards the marginal region the stellate parenchyma fills the air-passages, but in the central region as the air-passages expand, the tissue gets stretched and ultimately breaks down. Each air-passage is divided into sections by transversely placed diaphragms which occur at intervals. The diaphragms are transverse plates of tissue perforated by minute openings (Fig. 6). Goebel (11) and others believe that the diaphragms permit the passage of air but not of water and are a reaction towards water in which such plants live; while Le Blanc (3) considers them as a portion of the mechanical tissue system concerned with support. Owing to the development of large air-passages, the main photosynthetic tissue of the leaf is reduced to peripheral plates, situated towards the upper and lower sides of the air-passages, next to the epidermis. It is a weakly-developed palisade tissue consisting of 1-2 layers of compactly arranged cells with chloroplasts (Fig. 7). Tannin cells occur among the palisade and stellate cells, being more common towards the margin of the leaf. Along the margin the epidermal cell is developed into a short, sharp, sclerotic spine. The lower surface of the midrib region is prolonged into a prominent keel which is stiffened by two pairs of fibrous strands placed laterally (Fig. 1). Associated with the midrib is a median vascular bundle of the normal collateral type, common in Grasses and Sedges, with a strand of sclerenchyma on either face of the bundle. In the lower half of the leaf-blade the keel becomes very pronounced by the addition and enlargement of the air-passages (Fig. 2).

Leaf-sheath.—The sheathing leaf-base surrounds the flowering axis. The basal part of the leaf-sheath, which usually remains submerged in water, is lacking in a prominent keel and the hinge-cells on the upper surface are absent (Fig. 8). Towards the junction of the leaf-sheath and the leaf-blade, the hinge-cells make their appearance but they are few and not deep. Where the leaf-sheath merges in the joint of the leaf-blade, the sclerenchymatous strand on the upper face of the median bundle gets prolonged into a beak-like strand, reaching almost upto the hinge-cells (Fig. 9). The strand starts a little below the joint and stops at or a short distance beyond the junction of the leaf-sheath with the leaf-blade, thus serving evidently to strengthen the joint. In surface view, the upper epidermal cells, on the adaxial side, have straight walls, while on the abaxial side they have slightly sinuous walls. Stomata are absent on the adaxial surface of the basal part, while the abaxial surface bears very few stomata at rare intervals. Chloroplasts are absent on the basal region. Owing to the great development of the air-passages, the basal part is thick and spongy. The stellate parenchyma is greatly stretched and gets mostly torn.

Culm.—The flowering stem or the aerial culm is thick, spongy, sharply triquetrous with concave sides. The central region of the culm is composed of large, thin-walled cells with a few collateral vascular bundles. Each angle is divided into halves by a bridge of tissue running lengthwise from the central region to the angle. Each half is further divided into air-passages by transverse bridges as in the leaf-blade. Thus each angle has two rows of air-passages (Fig. 10). The mechanical tissue is composed of sub-epidermal strands of fibres. Larger collateral bundles are placed, at intervals, along the partition dividing the angle into the two halves; while smaller bundles occur in transverse bridges under each sub-epidermal strand. The air-passages are filled with stellate parenchyma and are crossed at intervals by diaphragms similar to those of the leaf-blade. The photosynthetic tissue occurs on either side of the air-passage. The stomata occur in grooves between the fibrous strands. On the lower part of the culm they are fewer, while on the basal part they are mostly absent. In the submerged part chloroplasts are absent and the cells of the bridges and of the central region act as storage tissue holding starch. Towards the apex of the culm, where the flowers arise, the central region is more compactly built while the air-passages are small and are pushed towards the sides. Embedded in the central region are a number of normal collateral bundles from which vascular strands are given off to the individual spikelets. Thus the ordinary conducting system is augmented in the region of the culm below the inflorescence. The angles, in the upper part of the culm, bear spines. Tannin cells are more numerous towards the periphery.

Rhizome.—The mechanical tissue of the rhizome is confined to a series of hypodermal ribs of sclerenchyma. The rest of the cortex is divided into two zones: an outer and an inner. The outer zone is composed of 3-5 layers of clear polygonal cells in uninterrupted contact and is mainly protective in function. The inner cortex is many-layered and shows a number of large lacunae separated by radially-placed plates of tissue. The lacunae are lysigenous in origin. Each starts just under the outer zone and advances inwards by the destruction of cells. The cells towards the endodermis are thin-walled, bluntly stellate with prominent spaces between them. The whole of the inner cortex is thus adapted for aeration of the rhizome which is submerged under water or lives in soaking soil. Concentric or amphivasal (leptocentric) bundles with xylem surrounding phloem, are scattered in the inner cortex, each bundle being placed in a radial plate separating the lacunae. Such amphivasal bundles constitute the leaf-traces.

The stele is large and contains many scattered, normally oriented bundles embedded in the fundamental tissue. The larger, centrally placed bundles are of the normal collateral type, each having an ordinary V-shaped xylem group with protoxylem lacuna and fibrous sheaths on either face of the bundle. The smaller, peripheral bundles are amphivasal (leptocentric) in which the xylem more or less completely surrounds the phloem, while others show an intermediate condition. As shown, in the developmental studies of various plants, by Chrysler (6), Plowman (16), Arber (1) and others the amphivasal bundles are derived from the collateral type through the xylem elements creeping around the phloem until they completely inclose it. The smaller amphivasal bundles are mostly the result of the introduction of the leaf-traces into the stele and some of them are continued as amphivasal bundles of the cortex. The pericycle is 3-5 layered. The endodermis is composed of cells with thick, brown walls. Adventitious roots originate from the pericycle. The fundamental tissue of the stele consists of thin-walled, rounded-polygonal cells with small intercellular spaces. Starch occurs in the cells. Scattered among the inner cortex and the fundamental tissue are vertically elongate tannin cells.

Stolon.—In the young parts, the epidermis is strengthened by a series of hypodermal ribs, while in the mature parts the cells between the ribs also become sclerenchymatous thus forming a 2-3 layered sclerotic mechanical tissue of a deep brown colour. The stolon repeats the structure of the rhizome. The outer cortical zone is composed of 2-3 layers of thin-walled polygonal cells in close contact; while the inner cortex becomes lacunar by the arising of lysigenous cavities which are separated by radial plates of tissue, each having an amphivasal bundle. The stele has vascular bundles arranged in more or less three concentric rings (Fig. 11). The bundles towards the centre of the stele are mainly of the normal collateral type, while those towards the periphery are of the amphivasal (leptocentric) type. The latter give out branches which are continued as the cortical bundles. The endodermis consists of prominent cells with brown walls and projects some distance upon the outgoing bundles. Adventitious roots arise from the pericycle. Starch and a few tannin cells occur in the inner cortex and in the fundamental tissue of the stele. The leaves on the stolon are reduced to scales at the nodes. The veins of the scale leaves are composed mostly of fibres.

Tuber.—The tubers are spherical or ovoid, dark-coloured, having a diameter of 2-3 cm. They are covered at the nodes with circles of scale-leaves and roots. The tuber arises at the apex of the stolon due to the expansion of the stele. A comparison of Figs. 11 and 12, magnified equally, brings out the contrast in size of the stele of the stolon and of a young tuber. The stele of the tuber attains a diameter 9-10 times that of the stolon from which the tuber arises. The swelling of the tuber is mainly due to the hypertrophy of the fundamental tissue of the stele in which the bundles are embedded. The cells of the fundamental parenchyma increase in size and later get fully loaded with starch. The bundles give out branches which anastomose and proceed towards the pericycle where they form a dense plexus of transverse and oblique vascular strands (Fig. 12). It is to this plexus that the root-strands and leaf-trace bundles are attached. Due to the expansion of the stele, the cortical zone appears comparatively narrow. The peripheral portion of the cortex is modified to form a 5-6 layered sclerosed hypodermal zone of mechanical tissue of a dark brown colour.

Root.—The piliferous layer is strengthened by a 1-2 layered hypodermal zone of sclerotic mechanical tissue. In the young root the cortex consists of 5-6 layers of thin-walled, rounded cells arranged with regularity in radial rows. In the old roots some of the cortical cells get destroyed and form lysigenous cavities separated by radial plates of parenchyma. The endodermis consists of large cells with brown walls. The stele is 7-8 arch. The pith is obliterated by two large metaxylem vessels which, in the older parts, fuse and form a single, relatively large vessel in the centre of the stele.

SUMMARY

The habit of the plant under wet and dry conditions is described.

The anatomy of the various vegetative organs is given and the mode of development of the stem-tubers is discussed.

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EXPLANATION OF PLATE.

Scirpus grossus Linn. *fil.*

Fig. 1.—T. S. mid-rib region towards the upper part of leaf-blade. *h*, hinge-cells; *v*, median vascular bundle; *a*, air-passage; *f*, fibrous strand. (×41).

Fig. 2.—T. S. midrib region towards the basal part of the leaf-blade. (×41).

Fig. 3.—T. S. leaf-blade. *f*, fibrous strand; *v*, vein; *a*, air-passage. (×51).

Fig. 4.—T. S. leaf-blade, showing the girder. *f*, fibrous strand; *s*, stellate parenchyma; *v*, vein. (×150).

Fig. 5.—High power detail of stellate parenchyma. (×500).

Fig. 6.—Part of a diaphragm-perforations unshaded. (×500).

Fig. 7.—T. S. part of lamina. *e*, upper epidermis; *g*, stoma; p, palisade cells; *s*, stellate parenchyma. (×500).

Fig. 8.—T. S. basal portion of the leaf-sheath, showing the midrib region. (×41).

Fig. 9.—T. S. leaf-sheath, showing the midrib region towards the joint with the leaf-blade. *h*, hinge-cells; *s*, strand of sclerenchyma. (×41).

Fig. 10.—T. S. part of culm. *f*, fibrous strand; *v*, vascular bundle; *a*, air-passage. (×51).

Fig. 11.—T. S. stolon. *s*, stele; *c*, cortex with vascular bundles. (×16).

Fig. 12.—T. S. tuber. *s*, stele; *c*, cortex with vascular bundles; *r*, adventitious root. (×16).

REVIEW

THE BIRDS OF KUTCH by Sálim Ali. Published for the Government of Kutch by Humphrey Milford, Oxford University Press. Pp. i to xviii and 1 to 175, with 20 coloured plates, depicting nearly 100 species, by D. V. Cowen, and 32 photographs. Price Rs. 20.

I awaited the arrival of a copy of Mr. Sálim Ali's latest work *The Birds of Kutch* with the keenest anticipation. Those conversant with the ability with which Sálim Ali compiled *The Book of Indian Birds,* already in its third edition, had every reason to expect something good and I feel they will not be disappointed. Certain defects in the book are obvious but these defects are largely those inherent in any work of this nature brought out in India under such adverse conditions as pertain in war-time. The paper is unfortunately of somewhat poor quality, but I gather it was with the greatest difficulty, and after much delay, that any paper at all was released. That used for the coloured plates is likewise not of a quality calculated to bring out the best from the artist's originals. I have seen Mrs. Cowen's paintings and can state categorically that the colours in the plates are insipid in comparison with the brightness of her originals. This is no doubt due in part to the difficulty of procuring suitable inks at this time, but India is not yet, I am afraid, in a position to produce first class colour work. The registration of the blocks has at times been faulty, causing blurred outlines and overlaps. Nevertheless these coloured plates are a great asset, being both artistic and accurate. Particularly pleasing are Plates 9 and 20, of certain birds of prey and ducks. There is considerable variation in the quality of the black and white illustrations, this fault possibly lying with the block-maker, but I feel that one or two enlargements of poor tone have been supplied for which the block-maker cannot be held responsible, as for example in the case of the photograph of Marshall's Iora on Plate IV. The binding is simple and effective, and the type used easy enough on the eye, but the sketch map of Kutch, a very necessary adjunct to a work of this kind, might well have been drawn to slightly larger scale. Had it taken up the whole page, it might have been possible to read the place names without the necessity of using a magnifying glass. There are a few printer's errors but on the whole the proof reading has been well carried out. Lastly, heading the index is a note to the effect that italics refer to illustrations; no italics have been used, so presumably the author changed his mind about indexing the illustrations but omitted to delete the note. Now let us take a glance at the text. The general layout, as stated by the author, follows in part that adopted by him in the *Book of Indian Birds.* That is to say, each description is divided into Size, Field Characters, Status and Distribution, Habits and Nesting. To this has been added for the benefit of the serious student a paragraph giving the actual range of measurements,—chiefly wing and tail—as taken from fresh specimens collected by Sálim Ali during the Kutch survey. To depict size, the author compares each species with one of 10 universally known birds; an admirable arrangement since in the field inches and millimetres can only convey a somewhat hazy impression of size. For instance the statement that the Pied Crested Cuckoo is about 'the size of a myna but with proportionately much longer tail', gives a very fair idea of the size and shape of that sleek cuckoo. As the majority of species listed are shown on the coloured or black and white plates, lengthy descriptions of plumage have quite rightly been omitted, but salient points to help in identification have been added under 'Field Characters'. For those who wish to delve deeper a reference to the second edition of the *Fauna of British India-Birds*, giving volume and page numbers, heads each description. As is only to be expected from the pen of such a painstaking and observant naturalist as Mr. Sálim Ali, the information regarding each species contains a concise but full summary of the bird's status, Distribution, Habits and Nesting, culled from all available sources such as Lester's *Birds of Kutch,* the Society's *Journal,* Hume's *Stray Feathers,* etc., but to this has been added a considerable mass of new information obtained by Mr. Sálim Ali himself as the result of the Ornithological Survey of Kutch carried out by him in the years 1943 and 1944. This book, in fact, adds a great deal to our knowledge of Indian birds as a whole, as well as being a revelation of the treasures of a none too well-known part of the subcontinent, namely that small, but ornithologically important, State of Kutch. In addition to the description of each species, there is an admirable Introduction giving very necessary information regarding the Physiography, Climate and Rainfall, and Vegetation of the area, as well as a most illuminating paragraph on Bird Migration, a pointer to the importance of Kutch as a 'Clapham Junction' for migratory hordes coming from, and to a certain extent returning to, the North and North-West, as well as from a great part of Eastern Africa *via* Arabia and the Indian Ocean. The work is rounded off by the inclusion of an interesting article on 'Goose-shooting in Kutch' by Maharajkumar Shri Vijayaraj taken from the Society's *Journal*. To sum up: this slender volume will prove of great use both to the serious worker and to the less scientifically-minded bird-lover. The price at Rs. 20 is not excessive, taking into consideration the large number of coloured and black and white plates and the difficulties which a long and bitter war has thrust upon both author and publisher.

R. S. P. B.

MISCELLANEOUS NOTES

1.—ABNORMAL BEHAVIOUR OF A TIGER.

Khajoori is a tiny village of barely a dozen hutments or so, in a remote jungle tract of a State in Central India.

The village itself is situated on a bare undulating plain, some 2 or 3 square miles in area surrounded on all sides by densely wooded hills. The inhabitants live by sparse cultivation and graze their cattle on the nearby grass land. The village belongs to a prominent *jagirdar* who maintains a *nakehdar* (collector of forest revenue) and it was he who related this extraordinary story to me while I was out there on a shikar trip. The incidents related below were corroborated by other witnesses and I have absolutely no doubt as to their authenticity.

The villagers, it appears, were greatly distressed by the fact that several of their cattle had been killed or seriously mauled in the past fortnight or so by a tiger. They were still more perturbed because they had no more effective weapons than bamboo *'lathis'* with which to ward off any further attacks he might make.

One hot night, when all the villagers were asleep in the open, they were suddenly aroused by a wild shriek and on waking were horrified to find that the tiger had seized a youth in his mouth and was stealthily walking off with him. The men reached for their 'lathis' and scrambled after him shouting and yelling and making a great hubub.

This perhaps had the desired effect, for the tiger dropped the boy, and after going a few paces turned round quietly and sat on the ground, watching them unperturbed where they had lined up some twenty yards away. (The local *nakehdar* was one of them.)

The unfortunate youth had been very severely mauled and lay on the ground bleeding profusely. An old man (the lad's father) slowly crept up to the boy and carried him back, while the others stood by, breathless, expecting a charge at any moment.

As soon as they laid him down, the youth regained consciousness. He began struggling with them in a frenzied, hysterical way, trying to rush towards the tiger, as they held him back, shouting *müjhë uskë päs jänë do* (let me go to him; let me go to him). Very soon the whole village was there and by beating tom-toms and throwing burning logs of wood at the tiger, they managed to scare the brute away. But the youth had bled so heavily that in about a quarter of an hour he was dead.

The idiosyncracies of this particular animal were numerous.

Soon after the incident related above, he decided to 'move into the village' as one might put it. Close to the group of huts—about 50 yards away, was an old peepul tree (*Ficus religiosa*) and it became customary for him to be seen sleeping under it in the day time. Or he would prowl along the road through the village and enter some hut and promptly go off to sleep for hours on end ! All this without so much as scratching anybody. Quite naturally the entire village was terrified, but after a week or two people got so used to the tiger's ways that they went about their normal business. The children (when the elders were out) went right upto him and he would just sit and calmly ignore them.

But with nightfall there would come on him the most extraordinary change. His tameness and docility would be gone. He prowled around the village growling angrily, and soon it became usual for people to huddle together in a locked hut for the night and no one dared stir out till the sun was well up.

Actually the mud huts with their thatched roofs were hardly any protection against a tiger but it was their good luck that he did not try to get inside !

One of his pet aversions, they found, was the cry of a baby. It was sure to bring the tiger to the door; but by day time he did not seem to mind.

To scare the tiger away a huge bonfire was made one night and the men sat round it hoping that the blaze would keep the beast away. It did not.

He came walking along as usual, and as he passed the fire, he stopped, and suddenly leapt into it and with sweeps of his paws, sent the burning logs flying all around him. The villagers scurried away while he was thus engaged. When eventually shot, two weeks later, his right forepaw was found blackened and charred. No old wounds were found on his body and it seems probable that he had never been shot at before. As a result of his 'fire fighting' he limped slightly, otherwise he attacked cattle as usual and went about his business seemingly none the worse for the experience.

An extraordinary incident brought about his undoing. When walking along the village lane one afternoon he took a queer fancy to some brass utensils he saw in a hut. The occupant, an old woman, was out in the fields and on her return she found the entire floor littered with bits of brass. The tiger had crunched them in his mouth and it would appear, that in so doing, he swallowed some chunks of the metal. From that day on he appeared ill. For a fortnight he went completely without food of any kind, and the villagers noticed that he often passed blood in his excreta.

Very soon he so thinned down that he was little more than a bag of bones and became so utterly weak that he did not have the strength to get up. He spent several days just lying under the shade of his favourite peepul tree. It was at this time, in answer to some six weeks of pressing requests to come to their aid, that the local jagirdar sent one of his shikaris to the villagers. They led him to the old peepul tree where the tiger lay, almost in his last stage. He looked up and surveyed them coldly as they approached and the shikari shot him.

PALACE ROAD,
NAGPUR, C.P. QUAZI Q. AHMED.
29th January 1945.

2.—ON THE HABITS OF THE MARBLED POLECAT, *VORMELA PEREGUSNA* (GÜLDENSTADT).

The Marbled or Tiger Polecat, *Vormela peregusna* (Güldenstadt) is found in Eastern Persia, Afghanistan and Baluchistan but is rare in Kabul. Last June I caught one in cornfield in the western part of the city, Chhardehi Kabul. It lives mostly on rats and mice. The animal is locally known as *Pallung Mush* or the 'Tiger of Rats', hence it is often kept by shopkeepers specially by bakers. The example I caught lived for about five months and became rather tame. It escaped twice and disappeared, but returned of its own accord, probably pressed by hunger, and came direct to me. It hardly allowed itself to be touched. If handled it would demonstrate with tail erect, and hairs a-bristle uttering a shrill and menacing shriek. This was always too much for our house cat, who, otherwise always friendly, retreated. When so protesting, the polecat gave off a very offensive smell which tainted the air very disagreeably for a considerable time. It would keep up a kind of groaning for some time even after its anger was abated. It would grip firmly with its teeth on a piece of meat and hang on even if suspended in the air. Helpless thus, the children were able to stroke it without fear.

The polecat lives in burrows. When digging, its chin and hind paws are pressed firmly to the ground and the earth removed with the fore-legs. Roots or other obstacles are gripped in the teeth and pulled out. My captive had little chance to dig, yet it frequently scratched the floor with its fore-paws, apparently to satisfy its desire to burrow. The animal moves backwards into its 'dugout' and sits inside facing the entrance. It licks its fur very much like a cat, sits upon its haunches or even stands erect on its hind-legs like a ferret or weasel, and when so erect peers and sniffs around. Its power of scent is decidedly not very keen.

Small birds, mammals and insects appear to be the main food. An egg was only eaten when its shell was removed from one end, and placed before it. My polecat then licked its contents clean, but the faeces showed that its digestion was disturbed by such food. Fat and tendons were not eaten. Nor did it take any meat if cooked, even when very hungry. It totally refused to take frogs, toads, or a fish. Fresh meat is eaten readily, especially spleen or liver. Birds were eaten whole with their feathers. After eating its fill the remains of a meal are taken to the burrow and stored for future use: a habit most probably developed from the scarcity of food in winter when there is little to be had on the snow-covered ground. When hungry our captive would even eat the muslin door curtains!

FACULTY OF MEDICINE,
KABUL. S. A. AKHTAR.
12th March 1945.

3.—MEASUREMENTS OF A SLOTH BEAR'S SKULL FROM ASSAM.

Mr. R. M. Pizey has sent us at the request of Mr. H. F. Meston the following measurements of the skull of a very large Sloth Bear which was shot by him in Mangaldai, Assam.

Length between uprights	...	$14\frac{1}{2}''=369$ mm.
Width	...	$8\,7/8''=226$ mm.
Height	...	$6\frac{3}{4}''=172$ mm.

The largest measurements recorded by Pocock, *Fauna of British India, Mammals,* vol. ii, 2nd ed., p. 145, are as follows :—

Condo-basal length.	Zygomatic width.	Locality.
345 mm.	219 mm.	Balaghat, C.P.

BOMBAY.
22nd June 1945.

EDITORS.

4.—A CARNIVOROUS SLOTH BEAR.

On the 20th February 1945 a large panther killed a cow in the vicinity of some rocky, jungle-clad hills. My machan was tied in a *mowha* tree in a field 25 yards from the carcass of the cow. At 7-40 p.m. a large bear arrived under my tree and started eating the flowers which had just begun to fall. After a few minutes of this appetiser, the bear made its way to the carcass of the cow, sat on its haunches and helped itself to such delicacies as it could find in the cow's stomach, finally gnawing the skin and meat off one of the front legs. After about an hour of this, it returned to my tree for some more *mowha* flowers before making off down a path, where it was met about 50 yards away by a she-bear with two cubs. The encounter appeared to cause mutual delight and it was evident that the first visitor passed on the information about the *mowha* flowers having fallen, as the she-bear then cantered gaily straight to the tree uttering chortles of delight as she came, followed by her cubs.

Mother and young then proceeded to the carcass and the three of them set on the stomach and intestines in earnest, one of the cubs finally extracting and removing the former into some bushes where with luscious sucking noises they all proceeded to devour it. Several times the cubs or the she-bear returned to the carcass to extract some other succulent morsel. The whole time in the intervals of loud inhalations and other slobbering noises, the bears seemed to keep up an animated buzz of conversation with one another. Finally at 9-30 p.m. they all departed.

The panther meanwhile had been giving tongue from a hill about 500 yards away, but was evidently deterred from approaching the kill by the formidable family of bears.

I remained in the machan until 11 p.m. and heard the panther's 'pheaul' noises every 10 or 15 minutes getting less distinct in the distance till 10 o'clock. He never returned.

The episode is of interest as it indicates the extent to which Sloth Bears, both young and old, relish a diet of meat, and also because this fact is evidently known to panthers, this particular panther certainly deeming it not worth his while returning to the carcass after the four bears had eaten their fill therefrom.

The moon was over half full and the episode provided one of the most interesting two hours' entertainment I have yet witnessed in the jungle.

Camp, Bara Dongar, R. K. M. BATTYE,
Bastar State. *Major.*
22nd February 1945.

[The Sloth Bear is perhaps the least carnivorous of our bears. It feeds mainly on fruits and insects. The eating of carrion, though observed occasionally, is exceptional.—Eds.]

5.—A SAMBAR'S DEATH.

At about 5-15 p.m. on the evening of the 27th December, 1944, Captain Ray and I were sitting on the west bank of the Bhimgoda Weir on the Ganges facing Hardwar. We were having a rest after a long day's shoot on the nearby islands and waiting for Lieut. Eaton, a member of our party, to join us. It started to rain so we decided to call it a day and return to the bungalow at Laljiwalah, and leave a message for Eaton to follow on. We stood up to have a last look around down the river, where peafowl usually come down to have a drink. To our great surprise we saw a large dark animal approach the river from the island and dive into the river. We were some 150 to 200 yards from the scene. It looked like a large pig from the back as we could only see its hind quarters. The animal then turned round and faced us with its body completely submerged, and we could discern that it was a large deer with its antlers sticking out of the water. Ray and two of the native beaters went down to investigate, while I stood and watched the scene. The deer every now and then would stand up and plunge its head into the water. When Ray was about 30 yds. from the river the animal again stood up, and I expected to see it leave the water and go back to the island and the forest when, to my surprise, it once again plunged its head into the water. Ray had now reached the bank and stood looking at this strange sight. He waved to me to come down, and on arrival at the river bank I was surprised to see a magnificent sambar in about 2 ft. 6 in. of clear water—some 10 ft. from the bank where we stood. It was kneeling on its front legs with the head resting on the river bed and its hind quarters protruding in the air.

The beaters said it was trapped in the sand and boulders but this I could see was not the case as I could see the bottom of the river. I immediately despatched one of the beaters to fetch some woodcutters who were going home and had reached the weir. While these men were coming down, the animal raised its head and turned towards us. Its mouth was wide open and the tongue hanging out as if it was gasping for breath. It then plunged its head into the water again, remained in that position for a few seconds and then turned over on its side. The men now arrived and 8 of them went into the water to pull the sambar out. It was still alive but expired when it reached the bank. It was now 5.30 and we had watched this drama for 15 minutes. The sambar was a beautiful, well-built animal in its prime with a lovely winter coat, in perfect condition and weighing about 300 lbs. the antlers being approximately 18 in. On examining the body we found that it had been shot through the left jaw—the bullet going through the tongue and coming out of the right jaw. The jaw was completely broken and the animal must have been in great pain. The wound was quite fresh. Lieut. Eaton had arrived and came down to see the animal while the woodcutters were cutting it up. There is no doubt that the animal, suffering extreme pain and unable to eat or drink, had come down to the river and deliberately taken its own life.

H. S. CROWLEY,

ROORKEE, U.P. *Captain.*

31st December, 1944. *K.G.V.O.'s Bengal Sappers & Miners.*

[The motive of suicide must be ruled out. No animal, except Man, not even the higher apes, is conscious of or able to recognize the state of death; as such, no animal can deliberately choose death as a means of escape from pain and other adverse circumstances. For the same reason it is incorrect to describe the instinctive behaviour manifested by hyaenas, opossums and other animals as 'shamming dead'. In the present instance the sambar was probably driven to the river by thirst. Its repeated plungings of its head into the water were probably vain efforts to drink. Death would have ensued with or without drowning from shock and exhaustion from its wounds.—EDS.]

6.—BREEDING HABITS OF SWAMP DEER (*RUCERVUS DUVAUCELLI*) IN ASSAM.

The Society seeks information relative to time of horn growth and development and the breeding season of Swamp Deer in Assam.

In a letter to the *Field* dated 23rd September 1944, His Grace the Duke of Bedford questions a statement made by Lt.-Col. C. H. Stockley that, in Assam, swamp deer rut when the stags are in velvet. As evidence, Col. Stockley (*Field*, 20th January 1945) quotes in full a note by Mr. C. A. R. Bhadian, 'On Swamp Deer in Assam', published in the Society's *Journal* (vol. xxxvii, p. 485). Mr. Bhadian says that in Assam, stags commence to grow their new antlers in April and May, and growth in velvet is completed in July-August. Velvet is shed and the antlers are hard from August to February, and in the instance of antlers which have matured in August—from September to March.

As regards the time of the rut, Mr. Bhadian says that this takes place between April and May *'when the male is practically without antlers'.*

Mr. Bhadian's statement as regards the time when stags shed their horns in Assam, and the period of their growth and development is at variance with the observations of other writers. Capt.

D. Moncrieff Wright, writing in our *Journal* (vol. xxxiv, p. 236), says that in Assam he saw 'stags with horns fully grown in velvet and in process of shedding their velvet in April'. This would imply that the period of horn growth in velvet is between December and April (growth to maturity takes approximately 5 months, vide Bhadian, *loc. cit.*, and Dunbar Brander, *Wild Animals in Central India,* p. 200 (U.P. & C.P.)). The period when the horns are hard would be between May and November. Capt. Moncrieff Wright's statement is supported by Lydekker (Royal Natural History) who says that 'single stags are met with on the plains of Assam during March with antlers in velvet.' Blanford (Mammalia) says that 'at the end of March in Assam bucks are found in grass singly with horns for the most part partly grown in velvet'. Swamp deer stags, like many other deer, live singly during the time of horn growth, and assemble in herds after the horns have hardened; such assemblage being preliminary to the development of the rut. The evidence of these writers indicate that in Assam horn growth of many stags is completed in April and May, when according to Mr. Bhadian the rut takes place.

In Mr. Bhadian's view there is no linkage between horn growth and the development of the rut. This is not the case with Swamp Deer in the C.P. and the U.P. Dunbar Brander writing of Swamp Deer in these provinces (*Wild Animals in Central India,* p. 200) says that the horns begin to grow shortly before the commencement of the rains (June), the period of horn growth and development is between July and October. The stags congregate in November and the rut does not develop till December reaching its climax between mid-December and January.

We should be glad to have further evidence on the following points relative to Swamp Deer in Assam:—

(1) Time of horn shedding. It should be noted that the time when antlers are cast is not uniform for all stags. Adult stags shed their horns earlier than younger animals.

(2) Period of horn growth in velvet.

(3) Period during which the antlers are hard.

(4) Time when the majority of stags rut.

(5) Time when the majority of young are born.

Bombay Nat. Hist. Society. S. H. PRATER,
15th April 1945. *Curator.*

7.—CANINE TEETH IN CHITAL (*AXIS AXIS*).

With reference to Mr. Nolthenius's note on the canine teeth in chital stags (Vol. 45, No. 1, p. 83), I should like to say that after examining a number of chital and sambar for these 'tushes' I have only found them in a very rudimentary form and then only in older beasts.

In Europe it is possible to estimate the age of a stag both from the colour and size of these tushes. In young beasts they are pure white and small in size. A fourth year stag has the centre of the tush a pale golden brown. This patch of colour darkens and grows larger with age.

The expression most generally used in Germany and Austria for these 'tushes' is *Kranel.*

I have always understood that these teeth were all that is left of the canines.

P. O. Box 67, H. A. FOOKS,
POONA. *Capt.*
12th January 1945.

8.—SIZE OF CHITAL (*AXIS AXIS*) IN INDIA AND CEYLON.

I was most interested in Mr. Tutein Nolthenius's note on chital (Vol. 45, No. 1, p. 83). I myself have seen in S.-E. Ceylon as good chital heads and as large bodied stags as anything in North or South India, and secured a good 'movie' record of them. Nor have I noticed any difference in body size between chital in North or South India and have seen as good heads (upto 37″ actually measured) from the Wynaad and the U.P.

S.E.A.C. H. G. ROSSEL,
13th January 1945. *Lt.-Col.,*
12 *Madras Engineers.*

[Pocock's conclusions as regards *Axis* deer (Larger Deer of Brit. India, Vol. 44, p. 169) were based on skull measurements. Average measurements of the total length and the condylo-basal length suggest that chital from north of the Ganges have smaller skulls than those from Peninsular India; while measurements of two skulls from Ceylon, from their small size suggest a nearer approach to the smaller skulls of Trans-Gangetic animal. Further measurements of skulls (total length and condylo-basal length) of chital from S. India and Ceylon would help to verify the correctness or incorrectness of this conclusion.—EDS.]

9.—ON EXPERIMENTS IN ALBINISM WITH CHITAL (*AXIS AXIS*).

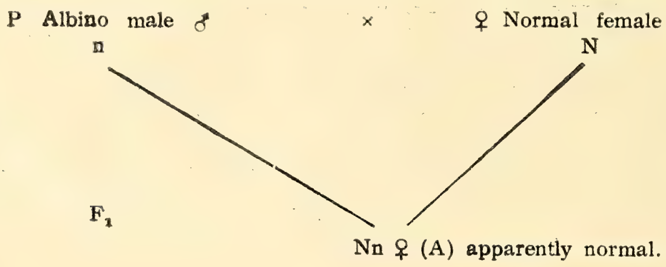
Whilst going through the pages of the *Journal,* I found an interesting note by His Highness the Maharawat of Partabgarh, Ram Singh Bahadur, on some experiments in albinism His Highness has been carrying on (Vol. 43, No. 3, Dec. 1942, p. 523). My previous experiments and work in this line suggest a possible explanation of the results obtained by His Highness of Partabgarh.

Having obtained an albino type of the chital stag (*Axis axis*), His Highness wished to fix such a type; for this purpose he crossed the albino male with a normal coated doe; the result was a normal coated female chital. This was again crossed with the original albino sire; the result was again a normal coated male, and on a subsequent occasion a normal coated doe (C). When C was once more crossed with the albino sire, the result was again a normal female (D). When D was put back to the albino sire, the result was two albino males (E and F).

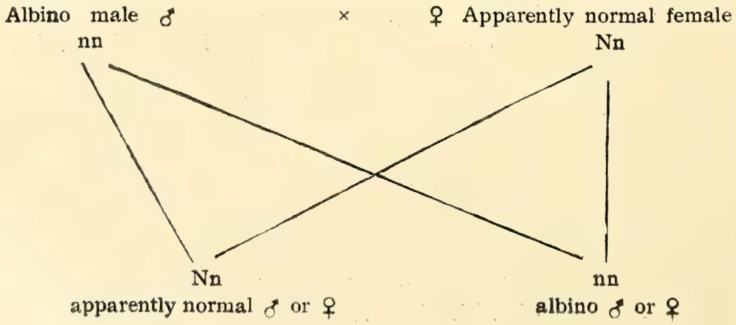
The technique followed is proper and rational. It is known for those vertebrates, whose genetic behaviour has been experimented with, that 'albinism' is a character that behaves as a 'recessive' to the 'normal condition'; my experiments with the common pheasant, *Phasianus colchicus,* further suggest that 'albinism' or 'normal coated condition' is a character that depends on a single factor for transmission.

If we assume that the normal coated doe was homozygous as regards the colour of its coat, and that 'normal coated' is dominant to an 'albino coated', we could only expect that the offspring would all be like the normal type, that is to say, *phenotypically* normal, but *genetically* heterozygous for the colour of the coat. If, therefore, we mate successively the 'dominant heterozygous' (i.e. the apparently normal female) to the 'recessive' albino male, we can only have two possible genetic combinations, with an equal chance of success in either case: either the product is 'apparently normal' (the 'normal' being in a heterozygous condition, as that of the mother), or it is of the albino variety.

In fact, if we call exhibit *N* the 'normal coat' dominant condition, and *n* the 'albino coat' allelomorph, recessive condition, the result of mating *N* with *n* will be *Nn,* that is to say, an individual apparently normal, but heterozygous for the colour of the coat.



The female *A* had the genetic constitution *Nn,* that is to say, under an apparent normality, possessed also the character for 'albinism'. Mating this female *A* to the sire, the expectation is 'albinos' and 'normal coated' products in the proportion of 50 per cent of each.



After repeated crossings of the 'apparently normal' females with the albino sire, His Highness at last obtained two albino male stags in the fourth generation; it is, however, scientifically inaccurate to say that the fourth generation bred true to type; for the genetic constitution of the female *D* is in no way different from that of the females *A*, *B* and *C*.

The fact that the albino type was only seen in the fourth generation was due to a mere chance; the probabilities for albino progeny in the second and third generations were equally strong as in the case of the fourth generation. Theoretically the results of the various matings (*A*, *B*, *C* and *D*) should have been 50 per cent albinos against 50 per cent normal coated animals. The only reason why His Highness did not obtain these results is the small number of births. If we wish in practice to obtain results approaching the proportions established by theory, a much larger number of experiments is necessary.

In the note referred to above, His Highness of Partabgarh mentioned another experiment, the crossing of an albino female parakeet (canary yellow in colour, with ruby eyes)—with a male blossom-headed parakeet (orange in colour with light pink head and ruby eyes), that is to say,

♂ *Psittacula cyanocephala* × ♀ *Psittacula krameri.*

I should be very grateful to His Highness if either through the pages of this *Journal* or otherwise, he lets me know the result of such an attempt. Genetically the experiment is a very interesting one for two reasons, the first being the question of interspecific hybridisation between two distinct species of the genus *Psittacula* differing in many somatic characters, and the second reason being the possible hereditary behaviour of the two colour anomalies, which are clearly two mutations and which must be adscribed to the phenomenon of 'flavism' rather than to that of 'albinism'.

A. M. TAIBEL,
Delegate Director of the Experimental Station of Aviculture of Rovigo, Italy.

INDIA.
November 1944.

10.—STRANGE DEATH OF A YOUNG CUCKOO (*CUCULUS CANORUS*).

While in Sonemarg, Kashmir, on June 25th of last year (1944) some friends showed me a nest of a plumbeous redstart (*Rhyacornis f. fuliginosa*) which contained a young cuckoo just hatched. Two eggs in an advanced state of incubation and belonging to the redstarts lay smashed on the ground, presumably having been ejected from the nest by the cuckoo. I intended to keep the nest under observation until the cuckoo should grow bigger before photographing it. Visiting it again on the following day, I was surprised to find the bird dead. Examination showed that the cuckoo had, by some accident, swallowed several strands of a quantity of human hair which had been used to line the nest. One end of the hairs was down the bird's throat while the other end remained attached to the bottom of the nest. Dissection (kindly performed by Mr. McCann) revealed that the hairs had reached the stomach where they became rolled into a large ball. A strand of hair was also caught up at the base of the tongue, and due to the peristaltic movement of the stomach, had been twisted tighter and tighter round the tongue until the bird was choked and killed. The strands of hair between the base of the tongue and the stomach had been subjected to such twisting that, under a magnifying glass, they look like the twisted wires of a length of cable.

It would be interesting to know if other readers have experience of young birds dying from a similar strange cause.

BOMBAY. W. T. LOKE.
15*th March* 1945.

11.—THE AVOCET (*RECURVIROSTRA AVOCETTA* LINN.) BREEDING IN INDIA.

On a recent visit to the famous flamingo nesting colony on the Great Rann of Kutch (19-23 April 1945) I came upon a considerable gathering of avocets on a flat muddy island exposed by the gradual drying up of the water. I had not met with this species at all during the Kutch bird survey (August to October 1943 and March/April 1944), and even now besides this one place it was not to be seen anywhere else in Kutch. My first impression was that the birds had collected here prior to emigration, but their general behaviour was somewhat odd and early excited suspicion. Pairs kept constantly flying overhead in a highly agitated manner, rather like nesting red-wattled lapwings, screaming *kleet, kleet, kleet* etc., continuously at the rate of about 3 per second. The quality of this sound was very like the call of the Stone-Curlew (*Burhinus*).

Suspicion deepened when a flamingo chick I was chasing to catch and ring, strayed into a spot where it was furiously set upon by one of a pair of avocets, while the other was assiduously fluttering along the ground doing the broken wing trick, presumably against me. A search soon disclosed an unlined scrape with 4 eggs. In the near distance, about two furlongs away (and within half a mile of the flamingo city) there were a thousand or more avocets dotted about. A little watching soon convinced me that they were not there merely on passage. As I approached the place a great many birds started running about, crouching, stretching open their wings above the back and doing the broken wing trick, while many took to the air flying around in agitation. At one time, more than 30 birds were fluttering on the ground all around me. It soon became evident that this vast concourse of avocets were actually nesting here. Standing in one spot I counted over 40 nests a few yards from each other. There were over 150 nests in an area of 4-6 acres, and beyond were hundreds more. The eggs were laid on the hard baked mud sometimes on a bed of mud pellets but mostly on the bare ground in a shallow unevenness. All nests contained one to four eggs on 21 April. Only two downy chicks were seen running about on the wet slimy mud near the water's edge some distance away from the nests.

Four full clutches were taken. Average measurements of 16 eggs 49.25 × 35 mm. Largest 54 × 36.5; smallest 46 × 34 mm. Unfortunately it was not possible to collect skins of the birds.

This is the first record of the avocet breeding within the limits of Peninsular India. The nearest it was known to do so is in Northern Baluchistan. After this experience I feel that a great many other waders (e.g. whimbrel) whose breeding in India has often been suspected, but never authenticated, may be found to do so on remote islands in the Rann. The Rann is an area which would well repay careful investigation at different seasons and, I am confident, produce many surprises.

33 PALI HILL, BANDRA,
BOMBAY. SÁLIM ALI.
3rd May 1945.

12.—THE WHOOPER SWAN (*CYGNUS CYGNUS*).

This swan is a rare visitor to India, and as far as I am aware it has so far never been recorded from Kashmir. On 20th February 1945, a Kashmiri punt gunner brought to the Srinagar Club a skin of this bird which he had shot the previous day at Badshahi Bagh. I examined the skin and found it to be an undoubted specimen of the Whooper, with the yellow on the bill extending right up to the nostril.

SIRINAGAR. F. LUDLOW.
10th March 1945.

13.—MIGRATION OF SWAN TO THE PERSIAN GULF.

Mr. G. B. Gilby, Cable & Wireless, Ltd., Bushire, writes: 'I enclose, three each, primary and secondary feathers from the wing of a swan which was shot in Bushire, on the 17th of December by Mr. M. Haddow, I.C.S., whose letter I am forwarding to you in original. From what Mr. Haddow tells me the bird was probably an immature specimen and was evidently wounded as it did not leave with its companions.

We are anxious to know exactly what type of swan this is and whether they are frequent visitors to this part of the world. In the 21 years in which I have been associated with the Persian Gulf I have not heard of a case of swans visiting this area. We have had an abnormal amount of rain this year which may account for their visit.' We publish below Mr. Haddow's description of the bird.

'In my opinion the bird was a swan, being much larger than any wild goose I have seen. It was entirely white in colour, with very pale brown patches on the back and wings. The feet were grey-black and the beak, which was at least 3½ inches long was black. The bird was obviously in an exhausted condition and did not wish to fly, and when put up merely flew about 300 yards at the height of 2-3 feet above the ground to another pool nearby. When swimming it kept its long neck very erect, which made it look unlike a goose on the water.

'The Persian lighthouse-keeper who appeared on the scene when we shot it, said that it had come onto the landing-ground the evening before with about 15 others, and had remained behind when the others flew on. He also had seen a flight of about 2000 of the same bird two weeks before which had spent the night on the landing ground. They had flown off in a north-westerly direction. He said he had seen similar birds in previous flighting through, and staying a night here when there was sufficient water for them to come down on.'

The three primary and three secondary feathers sent to us were certainly those of a swan, possibly a Whooper Swan (*Cygnus cygnus*). The length of the bill 'at least 3½ in. long' helps to support this view. Bills of other species measured from feathers to tip are smaller. (Bewick's Swan bill 90-98 mm. Mute Swan 73-90 mm.). The distribution of the Whooper Swan is Iceland, North Europe and North Asia. It migrates southward to Central and South Europe, more rarely to North Africa, Central Asia, Persia, India and China. So large a migration of these swans to the shores of the Persian Gulf is unusual and may have been influenced, as suggested, by abnormal climatic conditions.

EDITORS.

14. A NOTE ON BIRDS OF THE SIMLA FOOTHILLS.

Being fairly familiar with the birds of the Delhi district and those of the hills around Simla it has always been the writer's desire to see something of the avifauna of the 'gap' in between—the jungle clad foothills. Six days leave over Christmas last year enabled this ambition to be realistd by a very enjoyable stay at the P.W.D. Rest House at Koti (3,500 ft.) 7½ miles from Kalka on the Simla road. Many hours of scrambling on hillside paths and watching of skies, trees and undergrowth resulted in a record of an interesting mixture of plains and hills birds. The following list applicable to the winter is, of course, of necessity incomplete but may be of interest to others who have speculated on the contents of the 'plains to 4,000 feet' terrain.

(1) **Corvus macrorhynchos.** *The Jungle Crow.* As always the deep caw of this bird is the first greeting to the hills. Common—individuals and small parties. No House Crows seen.

(2) **Dendrocitta vagabunda.** *The Tree Pie.* Common around cultivation. Seen daily.

(3) **Parus major.** *The Grey Tit.* Common—often seen foraging on the ground of the bare terraced fields. No other species of Tits seen.

(4) **Garrulax leucolophus.** *The White-crested Laughing Thrush.* Cackling calls often heard, and seen on two occasions—once when a party was disturbed from thick undergrowth by a woodcutter and a second time when disturbed by a deer. Keeps to the lower parts of the valleys.

(5) **Ianthocincla rufogularis.** *The Rufous-chinned Laughing Thrush.* In spite of its reputation as an inveterate skulker this bird was seen on three occasions; the first time in the open at least four feet from the nearest cover! Another day two of them came some feet out into a ploughed field and spent over 5 minutes in the open affording an excellent opportunity for study of all the detailed points of colour and markings.

(6) **Trochalopteron lineatum.** *The Streaked Laughing Thrush.* Seen fairly frequently particularly in jungle on the edges of cultivation.

(7) **Turdoides somervillei.** *The Jungle Babbler.* Fairly common in the usual fussy parties in the more open country.

(8) **Pomatorhinus erythrogenys.** *The Rusty-cheeked Scimitar Babbler.* Seen once when an individual appeared at the top of a bush to pick off a red berry with the tip of its curved bill—staying to survey the countryside long enough for its description to be noted before descending suddenly into the undergrowth again.

(9) **Pellorneum ruficeps.** *The Spotted Babbler.* Seen on one occasion in thick cover after a wait of 20 minutes in the jungle. Two individuals observed with others heard in adjacent cover.

(10) **Stachyridopsis pyrrhops.** *The Red-billed Babbler.* This bird (with its brown bill!) is common in parties in the jungle clad nullahs and often seen but is so easily disturbed and so quick and restless in its movements that the collection of data for identification with field glasses is a matter of the noting of 'points' a few at a time.

(11) **Ixulus flavicollis.** *The Yellow-naped Ixulus.* Common—in parties particularly in small trees bearing a species of 'oakapple' fruit and often in company with White-Eyes. Presumably these two little species consort to admire each other's white spectacles!

(12) **Leiothrix lutea.** *The Red-billed Leiothrix.* Fairly common in parties in undergrowth.

(13) **Microscelis psaroides.** *The Black Bulbul.*—Why not the 'Grey Bulbul' which would be much more descriptive of its general colour? Fairly common in parties in trees in thick jungle.

(14) **Molpastes cafer.** *The Red-vented Bulbul.* Common particularly around cultivation.

(15) **Molpastes leucogenys.** *The White-cheeked Bulbul.* Very common. Almost every other bird seen is of this species and it seems to abound everywhere —in open country and in thick jungle.

(16) **Certhia himalayana.** *The Himalayan Tree-Creeper.* Fairly common but usually solitary.

(17) **Enicurus maculatus.** *The Spotted Forktail.* Occasionally seen along streams and irrigation channels.

(18) **Monticola rufiventris.** *The Chestnut-bellied Rock Thrush.* A pair of these birds were constantly to be seen near the bungalow the female usually making itself evident with its scolding alarm note. Incidentally, I have never found this bird so 'wild and shy' in summer in the Simla hills as the 'Fauna' implies.

(19) **Myophonus caeruleus.** *The Himalayan Whistling Thrush.* Fairly common near the hill streams but with song and calls nothing like as evident as in the summer and rains.

(20) **Eumyias thalassina.** *The Verditer Flycatcher.* Seen on three occasions—solitary.

(21) **Muscicapula tricolor.** *The Slaty-blue Flycatcher.* Occasionally seen in the nullahs near cultivation, the white patches in the tail always being conspicuous.

(22) **Alseonax ruficaudus.** *The Rufous-tailed Flycatcher.* Possibly, a doubtful identification but nothing else seems to fit. Seen on one occasion.

(23) **Niltava sundara.** *The Rufous-bellied Niltava.* Seen on two occasions—solitary in low jungle.

(24) **Chelidorhynx hypoxanthum.** *The Yellow-bellied Flycatcher.* An unfortunate trivial name for a very attractive and sprightly bird. Common—its poised half drooped wings, fan tail and the flash of bright yellow in its wheeling sallies from tree tops being notable.

(25) **Leucocirca albicollis.** *The White-throated Fantail Flycatcher.* Fairly common and almost as attractive as the last species in spite of its sombre colouring.

(26) **Orthotomus sutorius.** *The Indian Tailor Bird.* Common around habitations—seen daily.

(27) **Franklinia gracilis.** *Franklin's Wren-Warbler.* Seen on a number of occasions in small parties in cultivation and scrub jungle. Identified as Franklin's Warbler in winter plumage but somewhat doubtfully.

(28) **Phylloscopus occipitalis.** *The Large Crowned Willow-Warbler.* Occasionally seen—minus its conspicuous summer song.

(29) **Suya crinigera.** *The Brown Hill-Warbler.* Seen on one occasion only in sparse scrub on open hillside.

(30) **Acridotheres tristis.** *The Common Mynah.* Only noted once.

(31) **Passer rutilans.** *The Cinnamon Sparrow.* Fairly common in ones and twos in trees near habitations. No House Sparrow seen.

(32) **Emberiza cia.** *The Eastern Meadow Bunting.* Seen on two or three occasions on open hillsides in its dull coloured winter plumage.

(33) **Riparia rupestris.** *The Crag Martin.* (Possibly the Dusky Crag Martin?). A flock of 25 to 30 of these birds appeared on two occasions in the river valley below Koti preceding cloudy weather.

(34) **Motacilla cinerea.** *The Grey Wagtail.* Noted once (solitary) on hill stream.

(35) **Anthus hodgsoni.** *The Indian Tree Pipit.* Seen on two occasions on scree and scrub covered hillside.

(36) **Zosterops palpebrosa.** *The White-Eye.* Common—in small parties particularly evident probing into the 'oakapple' fruit of trees in jungle near cultivation.

(37) **Aethopyga siparaja.** *The Yellow-backed Sunbird.* Seen on two occasions but for so short a time that a full description could not be noted,—a possibly doubtful identification therefore.

(38) **Dryobates macei.** *The Fulvous-breasted Pied Woodpecker.* Fairly common. At first taken to be the Brown-fronted Pied Woodpecker but later checked by the complete red crown of the male and the black crown of the female.

(39) **Dryobates himalayensis.** *The Himalayan Pigmy Woodpecker.* Seen only on one occasion near the Rest House.

(40) **Cyanops asiatica.** *The Blue-throated Barbet.* Common. Heard daily and frequently seen in fruit bearing trees.

(41) **Tockus birostris.** *The Grey Hornbill.* Common in small parties in trees both in cultivation and thick jungle. These birds seemed to be of a clearer grey colour than the brownish grey of plains birds.

(42) **Psittacula krameri.** *The Green Parrakeet.* Fairly common. Small flocks and solos.

(43) **Glaucidium cuculoides.** *The Large Barred Owlet.* Seen on one occasion at 11.00 a.m. in thick jungle in the Koshalia river valley.

(44) **Sarcogyps calvus.** *The King Vulture.* Common—seen daily.

(45) **Gyps himalayensis.** *The Himalayan Griffon.* Common—seen daily.

(46) **Neophron percnopterus.** *The Neophron.* Not very common but seen occasionally.

(47) **Milvus migrans.** *The Common Pariah Kite.* Frequently seen in flight but on some occasions suspected to be *M. m. lineatus,* the Black-eared Kite, but not with any certainty.

(48) **Gallus gallus.** *The Red Jungle Fowl.* Common. Heard daily and frequently seen in parties foraging in the undergrowth or flapping away and wheeling into the nearest cover after being disturbed.

Notable absences from the above list which indicate uncommonness, at any rate in winter in the Koti area, are drongos (a careful watch was kept for the Hair Crested Drongo in particular) shrikes, doves and birds of prey. There is no doubt that the chief interest of the Simla foothills lies in the variety of laughing thrushes and babblers to be found in the undergrowth—if one has the patience to stalk these skulkers.

N. F. FROME,
C.I.E., D.F.C., M.SC.

15.—NOTES ON A FEW BIRDS FROM THE SOUTH OF THE TINNEVELLY DISTRICT.

(The numbers refer to Baker and Inglis's The Birds of S. India).

60. **Geocichla citrina citrina** (Orange-headed Ground Thrush). Single birds have been seen in December 1931, 1937, 1944, and in March 1943 one stayed in the vicinity of our compound for about a week.

235. **Clamator coromandus** (Red-winged Crested Cuckoo). Single birds have been seen in November 1936, December 1944, February and March 1943. Usually they stayed several days, and the most recent one was very tame, flying in and out of verandahs of several houses.

258. **Ceyx tridactylus tridactylus** (Indian Three-toed Kingfisher). This has been noted by mountain streams not ten miles away on 7th November 1943.

I thought I saw this bird near my house in the morning, and later in the day many of us were able to watch it on a tree beside the verandah. It flew down on to the ground after (?) ants several times. It spent at least seven hours near my house.

311. **Falco chiquera chiquera** (Red-headed Merlin). This is often seen flying over our compound. A nest with young was found on 21st April 1944 on a palmyra tree.

219. **Iynx torquilla torquilla** (European Wryneck). This was observed on 12th February 1943 feeding on the ground at the foothills, a few miles from here. It was captured and lived with us for a number of days and quickly became tame. It ate mostly black ants.

389. **Rallina superciliaris superciliaris** (Banded Crake). On 13th November 1931 and 30th October 1937 specimens of this bird have been caught inside our houses, having presumably wandered in from the garden in the dusk. In each case we released them in thick grass cover and they were not seen again.

394. **Gallinula chloropus parvifrons** (Indian Moorhen). This is seen—several pairs—in a tank near here every year between November and March. There is a good deal of cover when the tank is full. Where they go to when the tank dries up, I do not know.

431. **Sterna fuscata infuscata** (Sooty Tern). This was found, obviously unwell, in our garden on 24th April 1941. We kept it and fed it on small fish. It seemed to be recovering, and would fly 10-20 yards to take a fish from the hand of the one who fed it, when he called. But after about three weeks it died. There had been no severe storm at the time it was found, to account for its coming thirty miles inland.

451. **Himantopus himantopus himantopus** (Black-winged Stilt). In December 1934 and January 1935 a single bird and a pair respectively were seen, feeding at a tank edge.

508. **Ibis leucocephalus leucocephalus** (Painted Stork). On 21st April 1944 I visited the nesting colony of this bird in a village called Kunthakulam (mentioned by Mr. C. E. Rhenius in *J.B.N.H.S.*, vol. xvii, p. 806). It is about ten miles from here. There were about 200 nests of Painted Stork, not more than ten Spot-billed Pelican, and many Night Heron and Little Egret. The nests were built on *Azadirachta indica, Thespesia populnea, Delonix elata,* and one large Ficus sp. Some were on quite low trees. The birds were fishing in all the tanks and rice-fields around and bringing food to the young. Many of the parent birds stood with out-stretched wings to shelter the young in the nests, which were without any natural shade. The noise and the smell caused some of the villagers to suggest destroying the nests and driving the birds away some years ago, but the head-men of the village protect them. This colony seems to have existed for 60-70 years at least.

DOHNAVUR (30 miles north of Cape Comorin),
TINNEVELLY DISTRICT, C. G. WEBB-PEPLOE.
9th February 1945.

16.—ORNITHOSIS, A DISEASE TRANSMITTED BY BIRDS.

The following is reproduced from page 36 of *Time* dated the 8th January 1945.

'ORNITHOSIS'.

'The disease-scare headline of the week was that pigeons carry a virus which can cause virus pneumonia. In the *Journal of the*

American Medical Association, Army Lieutenants David C. Lovinson and John Gibbs and Philadelphia's Dr. Joseph T. Beardwood jr. reported six pneumonia cases definitely traced to pigeons—two had handled the birds and four lived in neighbourhoods where they could easily breathe particles from the bird's excreta in dust.

'This report confirms a belief doctors have had ever since the discovery three years ago that pigeons (40% of them in some areas) and many other fowls (sometimes even ordinary hens) carry a virus similar to that of psittacosis, the very much dreaded parrot disease. Both viruses produce a virus pneumonia, but the parrot virus is much more dangerous, usually killing about 18% of its victims. Both behave so much alike that medical men now refer to all bird-borne virus pneumonias as ornithosis, and call both viruses "members of the psittacosis group".

'Doctors think that pigeons may explain many cases of hitherto unexplained virus pneumonia. But so far no one has recommended shooting all the pigeons in City Hall Park—possibly because if the pigeon ornithosis were really serious everyone would have been lead long ago.'

It may perhaps be worthwhile reproducing this in the *Journal* for the interest of our members together with a suitable comment on the matter from a Medical authority.

BOMBAY. HUMAYUN ABDULALI.
10th April, 1945.

[Commenting on the above note Lt.-Col. S. S. Sokhey, I.M.S., writes:—

'Ornithosis is the name given to the infection—it may be transmitted by doves, pigeons, chickens, and the like, to distinguish it from a similar infection called *psittacosis*, transmitted by psittacine birds, such as parrots, parakeets, lovebirds, and also by canaries. The disease was first described in 1941 and since then there have been five papers on the subject all from U.S.A. Thirty-seven cases have been described. While in one series there was a case mortality of 4 in 10, another series of 6 did not have any deaths.

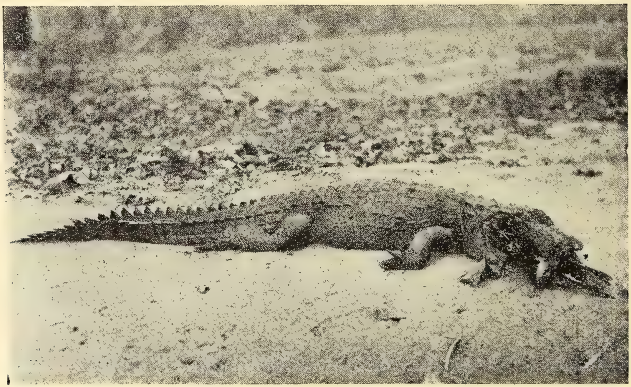
The virus of ornithosis is related to the virus of psittacosis and lympho-granuloma.'—EDS.]

17.—A CROCODILE'S MISADVENTURE. (*With a photo.*)

A flight of whistling-teal were sitting on some weeds about 40 yards from the earth *bund* in one of the larger Barsur tanks. Having only a .22 and a .30 Springfield rifle with me, I shot one of the teal with the .22 on the muzzle of which I had fitted a home-made silencer. The shot made hardly any noise but the teal flew up leaving one of their number struggling in the water.

In an instant a crocodile was ploughing over the floating weeds from some grass in which it had evidently been lying about 25 yds. away towards the struggling teal. Before I had time to change rifles the crocodile had seized the bird and dived.

Presently its snout appeared out of the water followed by the whole of its jaws and head in a vertical position. The teal was still in its mouth and it started trying to swallow it whole. I gave it a shot from the Springfield in the back of the head and it turned over and sank. Two Murias volunteered to swim out to where it had sunk and recover the body. I was reluctant to let them go as the weeds were very thick and the water was deep, but with a rope they were quite ready to try. One man swam out while the other held the rope just within his depth, but the search was fruitless and we were obliged to abandon it for the day.



The following day I realised that the muzzle cap of my Springfield had been left behind at the scene of the occurrence so I returned to search for it. The crocodile's body had then come to the surface and was floating where it had been seen to disappear. As there were no Murias in the vicinity at that time I stripped and swam in myself, seized the crocodile's corpse by its right forearm and swam back to the bank with it in tow.

It only measured about 5½ feet in length, but the teal was still in its mouth!

It is possible that the crocodile had not heard my shot at the teal and was so intent on retrieving the struggling bird that it did not notice me standing on the bank, nevertheless it was greed which cost it its life.

BARSUR,
BASTAR STATE.
30th March, 1945.

R. K. M. BATTYE,
Major.

18.—BELLOWING AND OTHER HABITS OF THE MUGGER (*CROCODILUS PALUSTRIS*).

Major Battye's note in the December *Journal* on crocodiles bellowing was interesting. While stationed in Ceylon last year, I had an experience of this, when camping with a brother officer by the large Kantalai Tank (over 8 square miles of water) near Trincomalee. We were out for 'movies' of Ceylon elephants to add to my Indian elephant films, and filled in the time in stalking some of the large crocodiles (*C. palustris*) in the tank. Incidentally, we found a service rifle quite ineffective in stopping these big mugger (unless hit in the spine) in fact very different in effect from the .318 I used for big garial (*G. gangeticus*) on the Indus in years gone by.

One afternoon we, separated by some hundreds of yards, were lying watching for mugger to emerge on a scrub covered island, when I noticed an apparently not very large mugger lying in the shallows with only its back, and tail flanges showing. I put it down as about 10 feet. Shortly afterwards my companion fired a shot in the distance, and at the sound, the mugger in front of me reared a truly colossal head from the water at an angle of 45 degrees, and let out a roaring bellow before dropping back with a splash. I hesitate to intimate the length and bulk of that really prehistoric and awe-inspiring head, but considering how much bulkier the mugger is for his length than a garial, I should imagine the beast certainly not less than 15 feet and probably more. It certainly appeared so in comparison with a 10 footer shot shortly before. There are reported to be many large mugger in this tank. Why the bellow was given on the *sound* of a distant shot is obscure.

A curious habit of the Ceylon mugger—which I have not seen in the U. P., where my previous experience of mugger has been—is to emerge in the evening, and lie out all night—certainly where they have been much disturbed.

I have never seen a garial walking with its body clear of the ground like a mugger—I do not know what others' experience has been.

S.E.A.C. H. G. ROSSEL,
13th January, 1945. *Lt.-Col.*

19.—SYNCOPE IN A CROCODILE.

Quite close to Datia in Central India are several large tanks; some right in the city where people bathe and fish (on the sly, not being permitted in the State) all around are pretty little old stone houses. There are other tanks, some five or six miles out of the city, one of the largest of which is flanked by a large stone wall, and a long flight of descending stairs takes you to the water level. These are the only remnants of what one day must have been a flourishing township.

During the monsoon the tank fills up rapidly and would then be about 2 miles across both ways, but in winter the level recedes considerably, and in May or thereabouts it generally dries up completely. Fish abound in this tank and quite naturally a lot of crocodiles (*C. palustris*) too.

Often on a winter day if one looks through 'binocs' one can quite easily discern their snouts slightly above the water as they half bask in the sun. But when summer comes round the tank becomes a scene of utter desolation with its parched and cracked surface and its filthy odour of decay. The crocodiles have to take a long track on dry land to the next water. This they undertake after dark and the journey is accomplished usually in one night but occasionally an individual miscalculates the distance to its next abode and is compelled to lie up for the day concealed in dense undergrowth, or it is, as may happen, surprised in its wanderings by the villagers and killed with their *'kulharis'* (hatchets).

There were five or six of us on the stone parapet beside the tank and it was about 6 in the evening. Down in the tank about fifty yards away a long black line (a partly submerged crocodile) was clearly visible in the water. One of the party, a State Jagirdar and a good steady shot, took careful aim and fired. The 'croc' slightly lifted to one side, and for a moment one just caught a glimpse of its creamy belly and then it just floated on the water, utterly still. Immediately one of the local 'Bunrakhas' (trackers) was sent down into the water to drag the 'croc' out. We could see it was a small creature, about 4 feet in length, and the man had armed himself with a *'kulhari'* as a safeguard. His task was easily accomplished for the crocodile was in shallow water and was now being dragged up the steps by the tail, the man putting in all his strength to do so. Man and 'mugger' were half way up the steps, when suddenly the animal showed signs of life. It jerked its head right and left in an attempt to get at the man, and swished its tail about angrily, while the poor chap (now at his wits' end !) held tightly on to it.

We shouted to him to hit it with his 'kulhari' (firing would not have been safe) while a couple of fellows dashed down to his rescue. He promptly released the mugger giving it in parting a sound blow or two on the head, which stunned the creature, and with the aid of others the 'croc' was finally dragged upto us. Close inspection revealed that it was completely unhurt. The bullet had not so much as touched its body anywhere. It was finished off with a hatchet.

The rifle used was a Savage 250/3000. Did the shock of its report or the terrific impact of the bullet near at hand, temporarily stun the animal?

PALACE ROAD,
NAGPUR, C.P. QUAZI Q. AHMED.
2nd February, 1945.

20.—A NEW RECORD OF A RARE SNAKE (*NATRIX XENURA*) FROM ASSAM.

I would like to record the taking of a further specimen of a very rare snake, first described under the name *Tropidonotus xenura* by Wall (1907) in this *Journal*, Vol. xvii, No. 3.

Whilst stationed near Kohima in the Naga Hills, Assam in May, 1944, a small and sombrely coloured snake was brought to me for identification, which, as I had only the old edition of the 'Fauna of British India' (1890) with me at the time, I was unable to identify. After making notes of the description, however, I despatched the specimen home to England for my collection with instructions that it should be sent to the British Museum, Natural History, for identification. The snake was subsequently identified at the Museum by Dr. Malcolm Smith as *Natrix xenura*.

The type specimen of *N. xenura* has been lost and the only others recorded by Dr. Smith in his recent edition of the 'Fauna of British India' are three in the Indian Museum from Cherrupunji in the Khasi Hills, Assam.

Descriptive details of the specimen I am recording are as follows:—

Costals all strongly keeled; two heads lengths behind the head, 19; midgody, 19; two heads lengths before the vent, 17. Ventrals, 158. Subcaudals in a single row, 66 in number.* Anal divided. Supralabials 9, with the 4th, 5th and 6th touching eye. Infralabials 9. 1 large preocular and 3 postoculars. Loreal 1, squarish but broader at the base. Rostral only just visible (i.e. its top edge) when looked at from above. Mental triangular, with a broad base. 5 infralabials in contact with anterior chin shields, the latter being shorter than the posterior pair. Colour very dark brown or almost black above, the majority of scales being flecked with a number of very minute olive dots, thus producing a faint olive tinge, particularly evident on the head. There is a series of small, buff coloured spots along each side of the back, these being more distinct anteriorly and entirely absent on the tail. Belly uniformly white, except for a dark brown spot at each outer edge of the ventrals and subcaudals throughout the entire length of body and tail. Supra- and infra-labials white with dark markings, the latter very well defined and larger on the supralabials. The measurements of this snake are: snout to vent, 16½ inches; vent to tip of tail, 5¼ inches.*

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*As the extreme tip of the tail was missing, this may account for a few additional subcaudals.

OFFICE OF THE D.I.S. AND C.,
O.I.D., J. D. ROMER,
SEWRI, BOMBAY. *Lieutenant.*
30th April, 1945.

21.—A NEW SERUM TREATMENT AGAINST SNAKE BITE.

The polyvalent anti-snake-venom-serum available hitherto was only effective against the venom of the Cobra and Russell's Viper. Subsequent research has however led to the production of a lyophilised polyvalent serum which besides being a remedy against the poison of these two species is also effective in neutralising the venom of the Krait (*Bungarus caeruleus*) and the Saw-scaled Viper or Phoorsa (*Echis carinata*). Its discovery represents a considerable advance in the means of treating snake bite in India, we take this opportunity of congratulating Col. S. Sokhey and his colaborators in the Haffkine Institute, Bombay, on their fine work. Only 5 snakes, the Cobra, the Krait, the Russell's Viper and the Saw-scaled Viper are, ordinarily, deadly to man in India. The fifth deadly species, the King Cobra, is limited to forest tracts. Fatalities from its bite are uncommon. Difficulties of securing sufficient venom of this snake for experiment, have prevented a test of the efficacy of the new serum in the treatment of its bite.

Through the courtesy of Lt.-Col. S. S. Sokhey, I.M.S., we publish below a pamphlet issued by the Haffkine Institute, Bombay, which gives general directions for the treatment of snake bite and for using the new lyophilised polyvalent anti-snake venom serum.

'The anti-snake-venom serum is prepared by hyper-immunizing horses against the venoms of the four common poisonous snakes of India, namely, (1) Cobra (*Naja naja*), (2) Common Krait (*Bungarus caeruleus*), (3) Russell's Viper (*Vipera russellii*), and (4) Saw-scaled Viper (*Echis carinata*). Plasma, obtained from the hyper-immunized horses, is concentrated and purified. Each c.c. of the concentrated serum neutralizes not less than the following quantities of dried venoms, when the serum is injected along with the venoms intravenously into white mice: Cobra, 0.6 mg.; Common krait, 0.45 mg.; Russell's viper, 0.6 mg.; Saw-scaled viper, 0.45 mg.

The serum is lyophilised by drying it from the frozen state under a high vacuum. The drying process is continued until the moisture content is reduced to less than 0.1 per cent. The dried serum, however, retains its affinity for water to the fullest extent, and, therefore dissolves rapidly on addition of water. This property is maintained by the dried serum even after storage for many years.

TREATMENT OF SNAKE BITE.

1. *First Aid.*

Snake-bite should be treated immediately. The measures to meet the emergency should be quick and positive. The following first-aid measures have definitely proved their value:—

1. *Ligation.*—A ligature of some type should be bound a moderate distance above the bitten part, to prevent the venom being absorbed into the upper part of the limb. The ligature may consist of a strip of cloth, a large handkerchief, or even a piece of heavy cord. A rubber ligature is much the best. It is necessary to make the ligature sufficiently tight to cause a stoppage of the circulation. Ligation should not continue for much over half an hour, and even then should always be slacked off at regular intervals of ten minutes during this time.

2. *Incision.*—Having thus retarded the absorption of the poison the fang-wounds should be opened by cross incisions a quarter of an inch long and a quarter of an inch deep over each fang mark. The incision should be made with care so as not to injure the delicate membrane covering a bone or to cut into a blood vessel. At this stage, it is desirable to give the first dose of the anti-

snake venom serum, preferably intravenously. For instructions see below.

3. *Suction.*—Drainage of blood and lymph from the cuts should be induced by suction. Suction should be done mechanically by means of a cupping device, which consists of a glass or metal cup with a rubber suction bulb attached to it. There should be at least two different sizes of cups in a snake bite kit—one of glass with a round opening of about one inch in diameter for flat surfaces, and another of metal with narrow, oval opening to fit against the surface of a finger or other rounded part. Mechanical suction should continue several hours after ligation has ceased. During the intervals in the suction treatment, the incisions should be covered with wet pieces of cloth saturated with solution of table salt or epsom salt in water, in order to promote drainage of lymph by osmosis.

If no cupping device is at hand, drainage should be induced by sucking the wound, there being practically no danger from this if lips and mouth are free from cuts and sores.

4. *Caution.*—It is well to wash the incision with a weak solution of potassium permanganate crystals in pure water (to produce a pale amethyst hue), as this solution will neutralise by oxidation what venom it may reach. But it is very dangerous to apply crystals or strong solution of potassium permanganate into wounds. Cauterizing the wounds is still worse for it actually seals the deadly poison within the tissue.

2. *Specific Serum Treatment.*

Once the venom has got into the circulation, it is only the anti-snake venom serum that can neutralize it, and in order to derive the greatest benefit out of serum treatment, the serum should be injected as soon after the bite as possible. As a first dose at least 20 c.c. of the reconstituted serum (see below) should be injected *intravenously*. The second dose should be repeated two hours after the first dose or even earlier, if symptoms persist. If the symptoms, which vary with different venoms, indicate persistence of venom action, further doses should be repeated every six hours until the symptoms completely disappear. In the case of a viper bite some serum should also be injected round about the site of the bite to prevent gangrene, which otherwise results owing to the very destructive effect of localized viper venom on tissue.

In cases of Cobra and Krait poisonings constitutional symptoms are more prominent than local pain and swelling. General intoxication is soon followed by a sense of creeping paralysis beginning in the legs and ascending to the head by way of the trunk. Paralysis of the muscles of the eyelids, staggering gait, incoordination of speech, paralysis of the limbs, drooping of the head and complete paralysis of all voluntary muscles develop. Nausea and vomiting frequently occur. Breathing gets more and more difficult and finally stops. In the case of Krait poisoning, in addition, there are convulsions and violent abdominal pains due to internal haemorrhages.

In cases of Russell's and Saw-scaled viper poisonings the local symptoms are prominent and severe. There is a great and persistent pain and intense swelling. There is constant and incessant oozing of blood from the punctures. Sloughing occurs permitting other infections. The constitutional symptoms are characterised by haemorrhages, both external and internal. Haemorrhages into the abdomen are responsible for pain, tenderness and vomiting. The death is due to heart failure; there is no paralysis.

It is well to remember that if nothing happens within ten minutes following a bite, the snake was harmless.

The venoms of Cobra and Common Krait act very rapidly if a large amount of venom is absorbed into the circulation. Hence, it must be understood, that unless the absorption of the venom into the circulation be retarded by ligation, incision and suction, the anti-snake-venom serum does not get a chance to neutralize the venom and save the victim. The first-aid treatment should, therefore, never be relaxed even if the serum is administered.

Intravenous injection of serum in horse-serum-sensitive subjects can produce very severe serum sickness and even acute anaphylaxis. Every care should be taken to prevent these reactions.

Intramuscular or subcutaneous injections of the anti-snake-venom serum are not as effective as intravenous injections. But if expert medical aid is not available, the serum may be administered by the subcutaneous or the intramuscular route. *The dosage should then be increased from 2 to 3 times that recommended for administration by the intravenous route.*

3. *Associated Treatment.*

In cases of Russell's and Saw-scaled viper poisonings sedatives, such as morphine, small doses of a barbiturate, or aspirin, may be given to relieve pain and nervousness. They should, however, be used with great caution in Cobra and Krait poisoning. For collapse, strychnine, pituitrin, or other general stimulants are of special value. In all severely poisoned persons, great relief is likely to be experienced from the infusion of a large amount of physiological saline, or still better, transfusion of blood or plasma, the effects of which may be life-saving in borderline cases.

RECONSTITUTION OF LYOPHILISED SERUM.

(1) Draw 10 c.c. of the distilled water in a sterile syringe.

(2) Cut a line with the file about halfway round the neck of the ampoule of lyophilised serum, and gently break open the neck.

(3) Transfer the water from the syringe to the serum ampoule.

(4) Cover the opening of the ampoule with the sterilized pad of handyplast, gauze surface downwards, press it down with the thumb, and holding the ampoule in the hand shake it vigorously for about one minute. For the purpose a piece of sterilized handyplast is provided; for use remove it from its cellophane cover.

(5) Now let the ampoule stand for one minute for the serum to clear. The reconstituted serum will become crystal-clear and ready for injection. Froth and undissolved particles, if any, should be left in the ampoule; excess serum has been added to allow for this.

(6) If the pad of handyplast falls on the floor after it has been removed from the cellophane cover it should not be used. Instead, the opening of the ampoule may be closed for shaking with the tip of the thumb painted with tincture of iodine or any other antiseptic carried in your first aid snake-bite kit.

(7) For the second and subsequent injections, you will have more time to dissolve the lyophilised serum. For these add 10 c.c. distilled water to the serum ampoule and rotate it between the palms of your hands until the serum is fully dissolved, and let the ampoule stand for serum to clear.

STORAGE.

Liquid serum is very unstable at room temperature. It requires storage at 0°C. to 4°C. Even then it deteriorates and 2 years from the date of manufacture, the serum is unfit for use. In India, proper cold storage facilities are not freely available and therefore liquid serum can only be stored at the risk of very rapid deterioration. Lyophilised serum obviates this difficulty. It is many times more stable than liquid serum. It should retain its potency for 10 years when stored in a cool dark place. Thus anti-snake-venom serum can be made available for use far away from cold storage facilities. It can be safely kept at rural dispensaries and even carried in a haversack on one's back if an occasion demands it. However, it is preferable to store it in a refrigerator if one is available.

EDITORS.

22.—REPTILES AND AMPHIBIANS OF VIZAGAPATAM AND NEIGHBOURING GHATS.

Whilst on a short and hurried trip to the Vizagapatam District in company with Mr. Humayun Abdulali at the latter end of May, 1944, we recorded the following species of lizards and frogs. Mr. Abdulali has already dealt with the avifaunal aspect of the trip and topographical conditions, so I need not refer to this again. (See p. 333 of this volume.)

Hamidactylus maculatus Smith.

According to the *Fauna,* 2nd ed. (*Reptilia*), this gecko has been so far recorded only from the 'Bombay district, Malabar, Tinnevelly, S. India, Salem, near Madras'. We obtained three specimens in the Forest Bungalow at Lamarsingi, 2,700 ft. This is a considerable extension of the range of this species.

Hemidactylus brookei Gray.

This species was seen in the bungalow at Vizagapatam. *Brookei* has a very wide distribution.

Sitana ponticeriana Cuv.

Quite common on the sandy shore where it dodges in and out of the masses of *Spinifex* and *Ipomoea pes-capra*. It is also fairly common more inland. The vivid colouring of the gular region of this lizard did not appear to me to be so bright as it is in the western representatives.

Calotes versicolor (Daudin).

The Bloodsucker was very common on the plain, but it was less so about Anantagiri, 3,000 ft. and Lamasingi. At Anantagiri we obtained breeding individuals with well advanced eggs.

Calotes elliotti Gunther.

At Anantagiri, this lizard was very plentiful and breeding was in full swing. It was also obtained at Lamasingi but was not so numerous as at the former place. At first glance *C. elliotti* looks very much like *C. rouxi* of the western side of the peninsula: the behaviour, too, is very similar, but it is a much larger animal (i.e. *C. elliotti*). The breeding colours of *elliotti* males are also similar to *rouxi*, black and scarlet, but the scarlet colouring is more extensive in the former. The female has a subdued blush only about the cheeks and throat. Like *rouxi* it is also a forest animal but comes out on to the road and open boulders.

According to the *Fauna* the distribution of this species is 'Southern India (Anaimalai, Tinnevelly and Sivagiri Hills; Malabar). Found in the hills up to 6,000 feet.' Hence the present record constitutes a considerable extension of the range of this species.

Mabuya macularia Boulenger.

A single specimen of this species was caught below Anantagiri at an elevation of about 2,000 ft., among dead leaves, its usual haunt.

Rana cyanophlyctis Schneid.

As usual, as in other parts of India, the Skipper haunted the tanks and lakes.

Rana tigrina Daudin.

The Bull-Frog was seen at Kondakala lake and in water on the way to Anantagiri, on the plain.

Rana limnocharis.

Seen among herbage skirting a well at Lamasingi.

Rana breviceps Schneider.

A single specimen was taken at night near a well at Lamasingi, where it had come to water.

Khacophorus maculatus Boulenger.

Several males were seen and heard calling in a well at Lamasingi—by tipping my companion over the brim and securing his legs we brought one to bag!

I cannot conclude this note without expressing my thanks to Mr. Abdulali for giving me the opportunity of accompanying him, and to Mr. and Mrs. Patak, our hosts at Vizagapatam, for the generous hospitality during our stay.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY. C. McCANN.
15th April 1945.

23.—BREEDING HABITS OF THE COMMON KRAIT (*BUNGARUS CAERULEUS*).

As I have noticed in an article in a back number of your *Journal* that it is unusual to find snakes in pairs after the laying of the eggs, the following may be of interest.

A large pile of loose lumps of sand-stone was being removed in a market garden some two hundred yards from my house by some boys in our school. Near the bottom of the pile a krait about 3 feet long was found in a small hollow between the lumps of stone. This was killed as it tried to escape. Then some eggs were seen. Eleven were taken out by the boys, and just as the twelfth and last was to be removed a second larger krait was seen, in another hollow between stones, beside the eggs. Later this was killed also. The eggs averaged $1\frac{1}{2} \times 4/5$ in. They contained fully formed snakes which would have hatched in a few days. One or two showed signs of movement when the eggs were opened. This took place on 17th April 1945.

Kraits are very rarely seen here except in rainy weather, when they are fairly common, and there had been no appreciable rain for several months. May is our hottest month. Presumably these snakes aestivate in such places as that in which this pair were found.

On the next day, while clearing a further part of the pile of stones, two more kraits were found and a second collection of fifteen eggs was uncovered at a place about five feet distant from the first. So that in all four kraits and twenty-seven eggs were destroyed out of quite a small pile of stones.

I am sorry that I was not informed at once of the second find, but I am quite satisfied that my informant is speaking the truth, and both finds were witnessed by at least 15 people.

DOHNAVUR,
TINNEVELLY DISTRICT,
S. INDIA. C. G. WEBB-PEPLOE.
28th May 1945.

[In an article on the 'Social Life of Snakes' (Vol. xxvi, p. 469), Mr. S. H. Prater discusses what is known about association between snakes. Such records as are available indicate that association between the male and female may continue after union has taken place and is sometimes prolonged even after the deposition of the eggs. Unfortunately the writer of the note did not ascertain the sexes of the kraits. If they were male and female his record is an interesting instance of prolonged association. The note also supports a previous record in our *Journal* that the female krait assists the incubation of the eggs by coiling around them. Undoubtedly more snakes than we are aware of do this. Commonly, the eggs are deserted and their incubation assisted by the heat of the sun and from the fermenting animal and vegetable matter in which they are laid. The number of eggs reported by the author of the above note is larger than previously recorded. The largest number so far recorded for the common krait (*B. caeruleus*) is 10, in this instance the writer records two clutches, one of 12, the other of 15 eggs.—EDS.]

24.—ON THE BIONOMICS OF THE BARIL [*BARILIUS BENDELISIS* (HAMILTON)].

The Barils are a group of small brightly coloured carps occurring in the rivers and other fresh waters of India. They prefer clear water with rocky or sandy bottom; and they are abundant in the hill streams. In the Madras Presidency, the Barils are represented by the following four species:—(1) *Barilius bendelisis* (Hamilton), (2) *B. bakeri*, Day, (3) *B. gatensis* (C. & V.), and *B. canarensis* (Jerdon).*

Over one hundred specimens of *Barilius bendelisis* (Hamilton) ranging in size from 0.8 to 12 cm. were collected from various sections of the Godavari, Kistna, Tungabhadra, Cauvery, Bhavani and other rivers and several tanks and examined for the purpose of this note.

The fish is both a surface and column feeder. The following is an analysis of its stomach-contents:—

Algal filaments, chiefly *Rhizoclonium, Cyclotella, Eunotia, Fragillaria, Melosira, Navicula, Nitzschia, Tabellaria,* volvox colonies, vorticellids, larval worms, insect larvae, parts of insects, daphnids, copepods and sand particles.

The fish breeds in the hill streams from July to December. During the breeding season the fish swims in small shoals of about 10 to 15, in which only 2 to 3 males have been noticed. Specimens with ripe gonad were collected from July to November; and fry were collected from September to February. On an average, the mature ovary contains about 90 eggs, each measuring 1-1.5 mm. in diameter. During the breeding season, the males are more brightly coloured, with golden yellowish operculum, greenish snout, orange-coloured lower jaw, tiny tubercles on both jaws, orange tinge on the paired and anal fins, and with yellowish but black-margined caudal fin.

The young fry are observed to swim upstream in shallow running waters in small schools of about 30 to 50. It is common for the parents to follow these schools till the fry attain a size of about 2.5 cm. If approached the fry dart towards deeper waters, but return after 1 or 2 minutes, and thereafter take no notice of the intruder. Fry below 1 cm. in length have an elongated body with prominent deep blue eyes, and without any demarcation between the anal and caudal fins, and with comparatively large ventral fins. A dark spot on each scale is developed when the fry is about 1.2 to 1.5 cm. The anal and caudal fins are demarcated, and the dorsal fin is well developed with a few dark spots on it at this stage. The dorsal half of the body and head gets grey coloured when the fry is 1.5 cm. in length. The coloured spots on the body show a tendency to group into descending bars on the sides of the body when the fry is between 1.5 and 2 cm. in length. On the dorsal side of the head, the spots group into a V-shaped pattern. When the fry is 2.5 cm. in size, 8 greyish bars are completely formed, 5 being predorsal. By the time the young fish attains 6 cm. in size, 11 bars (6 predorsal) are developed. The full adult features are attained when the fish reaches a size of 7 cm., 12 bars now being distinct. Thereafter, a gradual reduction in the number of bars take place. In the adults these bars become indistinct this observation substantiates Day's statement on this point.

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* *Barilius bola* (Hamilton), popularly known as the Indian Trout, does not occur in the Madras Presidency. Efforts are being made to introduce it from Bombay and Orissa, so that it may become a valuable addition to the English Trout already thriving in the Nilgiris.

The Barils are eaten by the poor people. They are popular with the anglers as one of the lesser fly takers. The fish are also useful on a moderate scale, as larvicides, especially in the hill ranges.

We thank Mr. G. K. Ramachandran, B.SC. (Hons.), Assistant Professor of Botany, Presidency College, Madras, for kindly identifying the algal filaments of *Rhizoclonium*. We are also thankful to the Director of Industries and Commerce, Madras, for kindly according permission for the publication of this note.

FISHERIES BRANCH,
DEPARTMENT OF INDUSTRIES AND COMMERCE, P. I. CHACKO,
MADRAS. R. S. VENKATARAMAN.

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25.—PARAFFIN WAX AS A PROTECTION AGAINST TERMITES.

As the value of the paraffin wax in checking the depredations of termites (whiteants) does not seem to be generally known, I should like to call your readers' attention to it through your columns.

My first knowledge of it came from sleeping on the ground when camping in a Madras compound which proved to be riddled with termite runs. Several of us used water-proof ground-sheets that we had prepared from unbleached calico by sprinkling grated paraffin wax over it and then running this into the fibre by passing a very hot iron very slowly over it. In the morning the undersides of these ground-sheets were found to be covered with termite mud, but to be unharmed and to have served as a complete protection to everything upon them, whereas all campers without them had had their blankets and some even their pyjamas badly eaten, some of the blankets having been reduced to rags.

At that time termites were a constant menace to the books in the Connemara Public Library, where almost all the shelves were built into the walls. In view of the above experience, therefore, I tried coating the insides of all the book-cases with paraffin wax. A great improvement resulted immediately, though termites quickly found their way through any small gaps that had inadvertently been left. This incidentally made these easy to locate and to fill in, since when all trouble from termites has ceased, the danger having been completely and apparently finally averted, for it is now a number of years since the treatment was effected. And the same method has subsequently been used with equal success in almirahs and boxes elsewhere.

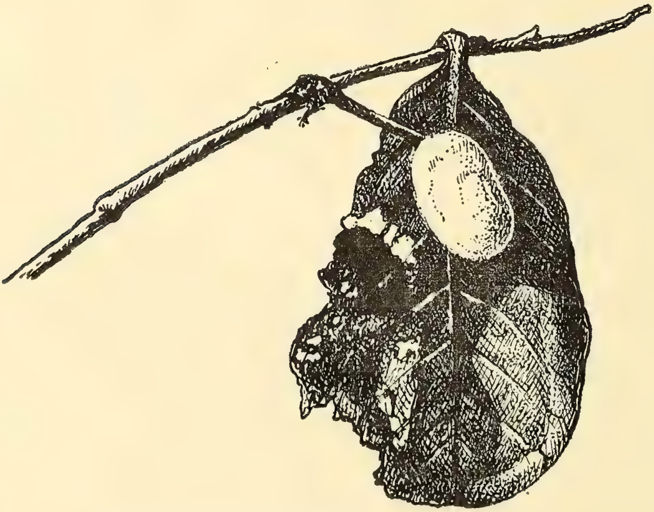
Obviously paraffin wax cannot be thus used everywhere. But wherever it can it affords complete and certain protection.

MADRAS. F. H. GRAVELY.
2nd February 1945.

26.—SECURITY MEASURES TAKEN BY THE PUPA OF THE TUSSAR SILK MOTH.

(*With a text-figure.*)

Last year (1944) on the 31st of January Mr. Sálim Ali and I found a cocoon of the Tussar Silk Moth (*Antheraea paphia* Linn.) which was attached to the upper side of a large leaf of *Terminalia catappa*. Besides being attached to the leaf, the cocoon was fur-



Cocoon *in situ* showing precautionary 'stem'.
[*From a photo by W. T. Loke.*]

ther made safe by a strong stem of hard resin-like material issuing from its top which was securely fastened to the branch of the tree from which the leaf arose. Thus, even if the leaf had fallen before the end of its pupation period (which it was about to do), the moth would still have been safe. It will perhaps be of interest to recall that Eha mentions a similar experience in one of his notes in the *Journal of the Bombay Natural History Society* in connection with the larva of the butterfly *Virachola isocrates* which feeds and pupates inside the fruit of the pomegranate. Some time before becoming a pupa the larva eats its way out and fastens the fruit to its stalk with silk thus preventing the fall of the fruit before the butterfly escapes. Eha experimented with a pomegranate infested with larvae by placing it overnight in an egg-cup. By the following morning the fruit was so securely fastened to the cup that fruit and cup could both be lifted up together. Eha then goes on to say :—'As far as I have observed it, the larva never leaves its shelter except for the definite purpose so necessary to its safety, and it taxes ingenuity to suggest any possible conditions under which some larvae might have performed the act in the first instance without purpose.'

Whether we agree or not with Eha on this last point, the actions both of the pupa of the Tussar Silk Moth and the larva of *Virachola isocrates* are certainly mysterious and interesting. Other readers of this *Journal* will perhaps have noticed similar phenomena: if so, we should like to hear from them.

The period which elapsed between the day we collected the cocoon in Hyderabad and the final emergence of the pupa as a full-fledged moth was just over 11 months.

BOMBAY. W. T. LOKE.
15*th March* 1945.

27.—MIGRATION OF THE COMMON ALBATROSS BUTTERFLY (*APPIAS ALBINA PRINCIPALIS*).

Flight observed on 5th April 1945 over 10 miles of road before and after Embilipitiya (S.-W. Ceylon). Movement generally north-westwards. Great swarms were seen either settled on or circling round damp patches on stream beds, silt ridges and other damp places. Flight kept mostly to the road owing to easier line of progress. In a clearing in a wood took two poor specimens of var. *flava*.

NO. 4, RESERVE BASE, P. ADRIAN D. LANKTREE,
INDIA COMMAND. *Craftsman, Tele. Mech., R.E.M.E.*
10*th May* 1945.

28.—ON THE LARVA OF THE BUTTERFLY (*CHILASIA CLYTIA LANKESWARA*)

On the afternoon of 1st April 1945, on a tree belonging to the group *Lauraceae,* I observed several *Chilasia clytia lankeswara* larvae in their characteristic positions, lying along the midribs of leaves, weighing them down, so that they hung head downwards, curiously all these larvae faced the same direction dorsally.

I obtained the nearest specimen, which had just completed the ecdysis before the adult stage, obvious from the loose puffiness of the new skin. It fed voraciously and grew rapidly, drinking quite a number of drops of water put in its path.

On the afternoon of 3rd April 1945, the larva began to wander. The yellow markings on segments 3 and 4 had translucent patches on them, and the larva had become more tapered towards the anal end, and had deposited a considerable mass of soft ill-defined excreta. I supplied some suitable dead twigs, and the larva chose and settled down, head upwards on one of these.

On the evening of the same day, the pupal site having been selected, the larva, anal end uppermost, began to spin its cremaster pad. This was really a triangular pocket, apex downwards and rounded off, the side opposite this apex being the open end of the pocket. The larva ensured that anchoring threads from the two closed sides of the pocket met on the reverse side of the twig.

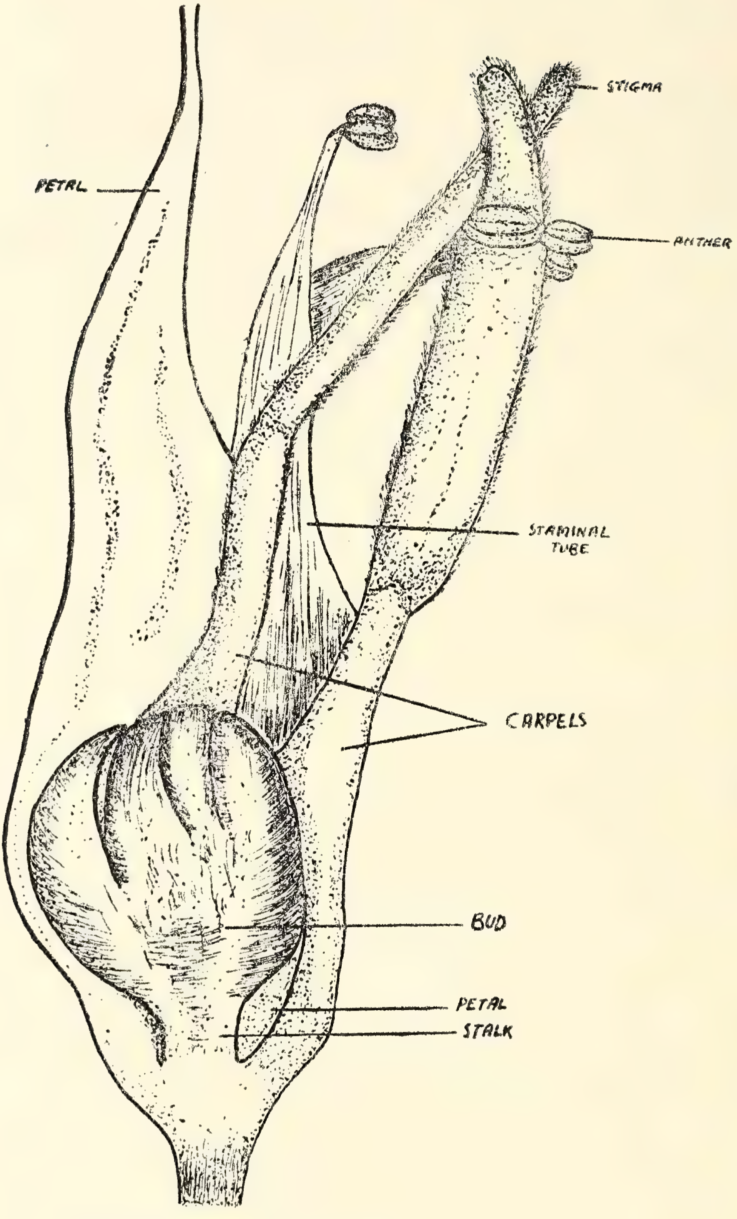
The pad finished, the larva re-inverted itself to its head uppermost position, inserted its anal claspers in the cremaster pocket, and extending and retracting over its length, worked the cilia on the anal pro-legs firmly into the silk. This done, gripping only with the third, fourth and fifth pro-leg, proceeded to spin the girdle.

Firstly, it bent backwards from segment 8, brought its head forward until as a whole it was 'S' shaped, then bent sideways until its spinnerets were within reach of one side of the twig, and made a silken attachment.

It then drew out the thread sideways until this first strand was caught round the fleshy part of segment 3 in front of the meso-thoracic legs (the larva retaining its 'S' shape until the last strand of the girdle was woven), and then continued bending laterally, rotating, in the opposite direction to affix the remaining end of the strand. This process was repeated 25 times in approximately half an hour, all 26 strands being co-incidental to form one, and the hump of the 'S' shape was worked laterally, never once being relaxed, beneath the forming girdle. Sometimes the larva made its strands meet at their ends on the reverse of the twig as in spinning the cremaster pocket.

Spinning the girdle appeared an uncomfortable and strenuous task, but having metaphorically 'got it over its chest', it now had to get its head through and slip it over its dorsal spines! Since the abdomen of the pupa of this species is curved to allow the pupa to lean out at quite an angle from the supporting twig, the loop is quite big (in comparison to the pupal girdle of e.g., the English *Papilio machaon*), but still it cannot be entered, without considerable contortion. (*Note*.—The leaning angle of the pupa completes its excellent resemblance to a dead twig which has been broken off near its base.)

It achieved this by bending over, laterally, to the right, still 'S' shaped, then twisting the first 3 or 4 segments anti-clockwise until its third pair of thoracic legs was through the loop, and then crawled with its 3 pairs of true legs on the twig until its whole body was straightened, and the loop dropped back over


STIGMA
PETAL
ANTHER
STAMINAL TUBE
CARPELS
BUD
PETAL
STALK

DISSECTED ABNORMAL FLOWER OF
DOLICHOS LABLAB LINN.

L. P. Khanna—**Dolichos lablab** Linn.

the fleshy spines (fourth pair), to come to rest between segments 6 and 7.

The larva finally stretched itself fully, gave one or two lateral movements, and relaxed completely save for second, third, fourth and fifth pro-leg pairs.

One hour after completion of the girdle, the larva relaxed its grip, hung by pad and girdle only, and gave its first few pre-pupal ecdysis exercises laterally.

The following evening of 4th April 1945, the red and yellow original markings were just shades of purple, and the pro-legs, flattened projections. The final larva-pupa ecdysis was completed by 11 p.m. just 84 hours from the commencement of the spinning of the pupal tail-pad.

No. 4 Reserve Base, P. ADRIAN D. LANKTREE,
India Command. *Craftsman, Tele Mech., R.E.M.E.*
6th May 1945.

29.—ABNORMAL FLOWERS OF *DOLICHOS LABLAB* LINN.

(*With a plate*).

Among a number of flowers of *D. lalab* brought for students for work in the class were a few branches bearing abnormal flowers.

In a number of cases the abnormalities were present in corolla, androecium and gynoecium. The stamens were in three bundles of 5, 4 and 1 and in some the number of the stamens was reduced with a corresponding increase in petals. The shape of the petals was different from the normal type. The gynoecium was unusual in number of abnormal flowers. The number of the carpela in the abnormal flowers varied from 2-5 and usually the condition was apocarpous though cohesion was present in varying degree. In one flower the carpel was open with naked ovules and there was a bud present at its base.

More or less similar type of abnormalities were observed in Rangoon, in *Caesalpinia pulcherrima* Swtz. The material with notes was sent to Prof. H. Gluck of Heidelberg University for collaboration.

Ewing Christian College,
Allahabad, U.P. L. P. KHANNA.
10th February 1945.

30.—A NEW VARIETY OF PAPAYA (*CARICA PAPAYA* VAR. *FLAVA*).

A Correction.

In the note on 'A New Variety of Papaya—*Carica papaya* var. *flava* from Travancore' printed in the August, 1944, issue at page 602 of this *Journal* an error has crept in. In the title of the note the new variety has been described as *C. papaya* var. *flava* from Travancore, whereas in the heading to the second para and in the captions to the three figures it is described as *C. papaya* var. *travancorica*. The latter nomenclature is incorrect, the correct one being *C. papaya* var. *flava*.

POONA. L. S. S. KUMAR,
2nd February 1945. A. ABRAHAM.

31.—INDIAN LAWN GRASSES.

In the Administration Report of the Madras Government Museum for 1938-39 I recorded methods that had been found successful in dealing with some of the most troublesome and persistent lawn weeds in South India, and called attention to the superiority of *Cynodon barberi* over all other grasses known to me for grassing lawns in Madras, since it combines good drought-resistance and small, relatively inconspicuous flowers with close, short growth, and a complete absence of underground stems. It therefore produces a much closer and tidier turf than does the better known *hari-hati* or *dhup* grass, unless this is constantly cut, and can more readily be prevented from spreading into flower beds, paths or drives.

Since my retirement to Kodaikanal I have found and used a grass with precisely the same qualities there. It resembles *C. barberi* so closely in its growth and general appearance that I at first presumed it to be that species, and was greatly surprised to learn that botanically it is regarded as a variety of *dhup* grass (*C. dactylon*), and that it is known as *C. dactylon* var. *intermedius,* though Mr. K. S. Srinivasan tells me that it differs from typical examples of this variety in having pointed hairs on the margin of the glume (as in *C. dactylon*) instead of club-shaped ones.

Lawns of mixed indigenous grasses tend to be even worse in Kodaikanal than in Madras, so that a foreign grass of strong growth and bright emerald green colour has been introduced and has become very popular. Garden lovers are now discovering, however, that its long and stout underground stems grow so rapidly and penetrate so deeply that it becomes a positive menace to neighbouring flower beds, paths, drives and even walls, where it becomes almost uncontrollable. *C. dactylon* var. *intermedius* provides a less coarse and far more amenable, though less brightly coloured, alternative.

Both *C. dactylon* var. *intermedius* and *C. barberi* can usually be distinguished from other grasses growing with them by the presence of paired instead of alternate side clusters of leaves on their long runners, though this character is less definite in the former than in the latter. In both long runners tend to form above the turf and need occasional cutting if the lawn is to look its best.

In conclusion, I must thank Mr. K. S. Srinivasan of the Madras Museum and Mr. T. S. Ramakrishnan of the Agricultural Research Station, Nanjarad, Ootacamund, for their help in identifying *C. dactylon* var. *intermedius*.

MADRAS. F. H. GRAVELY.
2nd February 1945.

32.—NEW PLANT RECORDS FOR BOMBAY PRESIDENCY.

In our rambles about Bombay and neighbouring districts it has been our fortune to find a number of plants of which there is no mention in Cooke's Flora of the Bombay Presidency; occasionally we have met with plants which are considered by Cooke as 'rare' or 'very rare'; due to such a want of ample material, Cooke's descriptions are, not seldom, very imperfect.

It is our intention in this and subsequent notes to supplement such descriptions. In every case our new description is based on fresh and ample material; and it is our sincere hope that botanists all over the Presidency will come forward with their new findings so that in the course of time the phanerogamic flora of Bombay may be fully and adequately recorded.

We offer today three plants, the occurrence of which in our Presidency has so far passed unnoticed.

1. **Acanthospermum hispidum** DC., Prodr. V, 522.

The genus *Acanthospermum* was described for the first time by Schrank in Pl. Rar. Hort. Monac. vol. 2 (1819), t. 53; the species *A. hispidum* was described by DC. in his Prodromus. The following is the translation of the generic and specific characters as given by De Candolle [l.c.]:

> 'Capitulum many flowered, heterogamous; ray florets uniseriate, female, ligulate-cucullate; disc florets male, tubular, 5-toothed. Involucre uniseriate, of 5 elliptic, concave bracts. Receptacle flat; outer paleae covering the ovaries, armed externally with herbaceous, hooked prickles; inner paleae concave, toothed at the apex, protecting the male flowers. Anthers apendiculate, not caudate. Branches of the style recurved, glabrous at the apex. Achenes tightly covered with prickly paleae, compressed, obtuse, sub-attenuated at the base. Pappus O.
>
> American herbs, branched, low or diffuse, trichotomous (?). Leaves opposite, punctate beneath. Floral heads solitary, terminal or in the forks of the dichotomous branches, comparatively small. Corolla yellow.
>
> *Sect. II. Ceratochlaena.* Outer paleae (that is, those covering the achenes) trigonous, not sulcate, produced into long horns.
>
> *A. **hispidum**.* Stem erect, hispid; leaves ovate, base cuneate, sessile, membranous, sub-hispid, sub-dentate from the middle upwards. Collected by Salzman in Brazil on sandy sea-shores near Bahia. Hairs long, white, spreading, articulated. Fruit exactly like that of the previous species, a little more echinate.' DC., Prodr. v, 521-2.

Among the various Indian floras in our library, we have only found a reference to this plant in Gamble's Flora of the Presidency of Madras, Part IV (1921), where on p. 704 Gamble writes:

> '*Acanthospermum hispidum*, DC., a South American introduced plant, has been found in S. Canara and Salem Districts, and is said to be spreading and likely to become common. The plant is hairy, the leaves obovate, spathulate; the heads in the forks of dichotomous branches, the achenes spinous.'

The first time that this plant was brought to our notice was from a letter of the Right Revd. The Bishop of Bombay, R. D. Acland, M.A., of December 2nd, 1944:

> 'These are the inadequate remains of the strange Composite which I mentioned to you the other day. Is there enough to identify it by? Shall I send to Poona for more, if now available?
>
> It appears to be a foreign weed, not in Cooke's Flora, that has established itself in great quantities on uncultivated land round about the Parbati temple.

I call it a Composite because in the centre of the curiously rayed flower heads there is a cluster of about half a dozen typical composite tubular florets, extremely small, while at the ends of the now hard and prickly rays there were typical, tiny, ray florets (ligulate), one to each radiation.'

Shortly after receiving this note, we found the plant at Mumbra, about a quarter of a mile from the G.I.P. local station, along the main road towards Bombay (No. 5527 in Blatter Herbarium, St. Xavier's College, Bombay). The plant at first sight might be mistaken for a young specimen of *Xanthium strumarium* Linn.; in fact the plant was growing in a clump of *Xanthiums*; but the floral heads and especially the fruits of *Acanthospermum* are quite distinct and totally different from those of *Xanthium*. There is an outer whorl of 5-6, or occasionally 8, echinate and horned achenes spreading star-like and surrounding a group of minute, pale yellow, tubular, male florets. The female outer florets are also yellow, but they are ligulate and slightly bigger than the male disc florets.

2. **Campanula canescens** Wall. Cat. 1289.

This is another plant of which there is no mention in Cooke's flora; the following description is taken from C. B. Clarke in Hooker's *Flora of British India*, vol. III (1882), p. 439:

'*C. canescens*, Wall. Cat. 1289; hairy, leaves oblong or lanceolate crenate, calyx teeth linear-lanceolate, 1/10-1/5 in. A. DC. Prodr. vii, 473.

Throughout Northern India; alt. 0-5,000 ft., from the Himalaya to Central India and Pegu, very common. Ceylon, Thwaites.

Stems 6-24 in. Leaves 1 by 1/4-1/3 in. Flowers numerous, clustered in panicles, dimorphic (both forms frequently on one stem); one form complete, the other very much smaller without corolla or stamens. Calyx-teeth 1/5 in. in the perfect flower, often scarcely 1/12 in. in the imperfect. Corolla 1/4 by 1/5 in., broadly campanulate, shortly lobed, grey-purple. Ovary 3-celled, or in large examples 5-celled. Capsule 1/5-1/4 in. in diameter; or in the imperfect flowers often scarcely 1/10 in., producing perfect seeds. Seeds very minute.'

In an old copy of Hooker's Flora that was frequently used by the late Fr. E. Blatter, there is a marginal note in pencil in the hand-writing of Fr. Blatter stating that he found the plant at Panchgani. T. R. D. Bell collected the same plant at Ambavadi, Thana district, N. Konkan, in February 1918 (Sedgwick's Herbarium, St. Xavier's College, nos. 3618 & 3618 II). During the Christmas season of 1944 we found the plant growing and in flower at Purandhar, Poona Dt. (No. 5738 & 5738 II, Blatter Herbarium); the plant was nowhere abundant, but it was spread all over Purandhar hill, in gardens, along the paths, etc.; on some of the specimens all the flowers were of the imperfect type mentioned by Clarke; other specimens had perfect flowers mixed with imperfect ones. Our specimens agree in all respects with Clarke's description except for the colour of the flower: in old flowers the colour was greyish-purple, but fresh, young flowers were of a brilliant purplish-blue colour. The whole plant is covered with spreading hairs; on the calyx such hairs are found along the midrib of the lobes, from the base to the very tip; the leaves are covered on both sides with stiff hairs which are spreading or appressed. The size of the leaves in Sedgwick's specimens is up to 1.75 x 1 in.

3. Aeginetia pedun Wall. Pl. As. Rar. iii, 13, t. 219.

The following is the description of the plant as given by J. D. Hooker in *Fl. Br. Ind.* IV, (Jan. 1884), p. 320:

> 'Scape short, stout very fleshy many-fld., flowers on long peduncles, bracteate at the base, corolla-tube yellow mouth blue, placentas 2 each of 2 plates.
>
> Throughout India, on the roots of grasses, from Murree, *Elliot,* Sikkim, *Clarke,* and Assam, to Travancore and Singapore.—Distrib. Cochin China, Java.
>
> Whole plant 3-6 in. high, red or yellow. Stem very short, as thick as a swan's quill, buried in the soil, giving off numerous alternate pedicelled flowers that rise above the surface of the ground, rarely slender and 1-fld. Peduncles 1-4 in., slender to stout, bracteate at the base; bract 1/4-1/2 in., ovate obtuse. Calyx 1 1/2-2 1/2 in. long, fleshy, red then yellow white, loaded with mucilage, tip obtuse, acute or shortly beaked. Corolla-tube as long as the calyx, yellowish, limb bright violet, lobes crenate and erose. Anthers of lower stamens with large dorsal fleshy decurved horn. Stigma broadly cordiform, peltate. Capsule ovoid. Seeds brown.—Wight's figures represent the placentas as more divided than other analyses show.'

This plant grows abundantly on the slopes of Behram's Plateau at Khandala on the Western Ghauts, just above tunnel no. 23 of the G. I. P. line Bombay to Poona; it was found growing on the roots of various grasses. The following description was written at Khandala on Sept. 4th, 1943, and was based on fresh specimens collected that very morning at the place mentioned.

Peduncle of flower up to 2.5 in. long. Bract at the base of the flower about 3/8 in. long, triangular, acute; calyx spathaceous, split down one side to about half its length, up to 2 in. long, inflated, 'dirty' yellow in colour, coriaceous, glabrous, inclined to be angular (perhaps this is due to the pressure exerted by the neighbouring flowers). Corolla tubular, with 5 free, subequal lobes; tube curved; limb of the corolla slightly 2-lipped, the lobes orbicular, margins undulate. The colour of the corolla lobes is purplish-blue with a bright yellow spot in the centre of the midlobe; throat yellow; tube white. Stamens 4; filaments stout, glabrous, inserted on the corolla tube. Style incurved, stigma large, umbonate, white. Ovary superior, 2-locular, ovules many in each loculus; ovoid, about 3/8 in. long, divided into two lobes by shallow, longitudinal depressions. Stamens, stigma and ovary included. There is an abundant mucilaginous secretion between the calyx and the corolla tube. (Nos. 2605, 2606, 2607).

On October 1st, 1943 the plant was still in full bloom at the same spot. A specimen collected at this later date shows remarkable abnormality in that one flower is perfectly regular in structure and colour and the number of petals was 6 in place of the usual 5; each one of the lobes of this flower had a bright yellow spot in the centre. The other flowers on the same plant were 5-lobed, slightly two-lipped with but one single yellow spot in the centre of the midlobe of the lower lip. The abnormal flower has been preserved in formaline in the Blatter Herbarium (No. 2775).

Acknowledgements.

Our sincere thanks are due to Dr. S. K. Mukerjee, Ph.D., the Curator of the Calcutta Herbarium for helping us in the identification of *Acanthospermum hispidum* DC.

St. Xavier's College,
Bombay

April 1945. H. SANTAPAU, S.J.

33.—SOME COMMENTS ON 'A SKETCH OF THE BOTANY AND GEOGRAPHY OF NORTH BURMA'.

Those interested in North Burma will be grateful to Kingdon-Ward for his valuable monograph entitled 'A Sketch of the Botany and Geography of North Burma, parts I & II of which were published in the August and December 1944 numbers of the *Journal.* Is it too much to hope that he will one day produce a flora of the area, even though the materials be inadequate or at least a guide to the more beautiful flowering plants and shrubs? Such a guide would greatly enhance the interest of a visit to the area, and who is better qualified to write it than Kingdon-Ward, with his unique field experience of North Burma?

One or two minor errors in the monograph need to be corrected. On page 557 he writes:—'South of Fort Hertz the Nam Yak, rising in the western range, joins in; its broad valley forms the southern boundary of the plain.' The Nam Lang is the river that forms the southern boundary of the plain. The Nam Yak rises at the Chaukan pass and after describing a wide U finishes up with a 12-mile stretch running almost due north to join the Nam Lang a few hundred yards above its junction with the Mali Hka.

On page 558 (top) he writes :—'Two other shorter rivers join the Taron immediately east of where the Nam Tamai parts company from it, both flowing from the north. These are the Dablu and the Tazu . . .' In actual fact the Dablu Wang is a tributary of the Nam Tamai, and joins it about 2 miles north-west of the Taron junction.

On page 553 he states that in 1922 he reached the Taron for the first time and continuing south-east reached Hkamti Long via the Nam Tamai. Hkamti Long is south-west of the Taron.

On page 17 of the December issue he writes: 'Few villages appear to last more than 20 years; quite a number scarcely last ten'. The people certainly move about a good deal, but taking the Nam Tamai as a whole the majority of the villages are found exactly where they were when mapped by the Survey some 25 years ago. The backward Nung tribes of the Taron and upper Nam Tamai valleys seem to be the most mobile; in the Putao subdivision the most noticeable changes have taken place in the Dablu and Nam Tisang valleys; all the villages in the latter north of Nogmung except one, and nearly all the villages in the former have vanished. The Kachin villages of the Konglu tract and the Nung and Lisu villages of the Ahkyang and lower Nam Tamai are much more stable.

On pages 18 and 19 the absence of permanent cultivation, away from the Tibetan villages, is attributed to lack of tradition and insuffcient population. Those are probably the most important factors: others that might be mentioned are lack of tools and abject superstition. Small areas of terracing occur in the Lakin valley and round Htawlang and Namretung, and more noticeably up the Ahkyang valley between Abumtang (Abuta) and Zangyaw. The rice crop in the Nam Tamai taungyas has been poor for the last 3 or 4 years, total failure in some places, partial in others. Asked why they did not go in more for terracing, the headmen gave lack of tools (mamooties, spades, shovels) as one reason, lack of time as another; the tendency seems to be to abandon the few terraces that exist rather than to construct more. As an example of the inhibiting effect of superstition the case of Gawai in the upper Nam Tamai might be quoted. Here the villagers some years ago, so I was informed, terraced a small area for wet paddy cultivation; but a number of them happened to fall sick that year, and the local 'myihtoi wa' or village seer pronounced that the Nats were offended, so the terraces were abandoned and are still out of commission. The largest area of permanent cultivation seen was at Nogmung, the largest and most prosperous Nung village in the area; here some 20 acres of paddy land have been laboriously hacked out of virgin evergreen forest on the flat alluvial land beside the Nam Tisang, and the area is being enlarged year by year.

On page 560 the book *Birds of Burma* is dragged in by the tail ('Botany' may be a vague term as stated on page 551, but I was not hitherto aware that it covered the study of birds) to receive a few passing kicks. As I have, I believe, read every book Kingdon-Ward has ever written: and those on Burma in particular have been a source of consolation in desolate places far removed from mountains: it would be a poor tribute to his powers of description were it true, as he suggests, that I was 'quite unable to visualise North Burma'; having in the past year seen considerable areas of it, both from the air and from the ground, from Saramati to Ka-Karpo Razi, I find it differs little from the picture I had formed of it except that the birds are much fewer and more far between than I had imagined.

I recently toured extensively in the Putao subdivision, covering 800 miles on foot; I followed the Nam Tamai valley from Htawlang (just north of the Lakin stream) right up to the last village in the Adung Valley, also up the Ahkyang Valley to Nyitadi, the Taron Valley to the China border, and the Seinghku Valley to Guba. The paucity of bird life in this area in winter, both in number of species and in number of individuals, is very marked, and I saw few of the species I had hoped to see and none at all new to Burma, although I tried all elevations up to 11,000 ft.

I was, unfortunately, about a month too early to see 'the vast procession of migratory birds passing up the Adung Valley.'

How many species still remain to be recorded from North Burma is a matter for opinion; I think Col. Stanford was too modest when he stated or implied that many had eluded him and the local villagers who collected for him. He has spent months collecting in the mountains of the Htawgaw and Hpimaw areas, and Lord Cranbrook spent a whole season in the Adung Valley; I saw nothing to indicate that there are vast numbers of undescribed species in the intervening area, and I should be most interested to know what are the 50 species new to Burma that Kingdon-Ward wagers he can find in North Burma.

I do not maintain that the Burma list is anything like complete. When I wrote 'with remarkable complacency' that 'the chances of meeting with a bird not described in this book are remote . . .' I had in mind *the average reader*: the business man, the Govt. civilian, the army officer, etc., who in the course of his daily round will be lucky if he comes across a species new to Burma; I would wager that not one in a hundred of those who read the book will ever explore the remote mountains of North Burma, still less encounter Kingdon-Ward's guaranteed 50 species, and a 1 in a 100 chance may fairly be described as remote. Had I written 'the chances of finding anywhere in Burma a species not described in this book are remote' Kingdon-Ward's criticism would have been justified; that he has interpreted my remark in this sense my clumsy pen is to blame.

FORT HERTZ.
15th March, 1945.

B. E. SMYTHIES,
Burma Forest Service.

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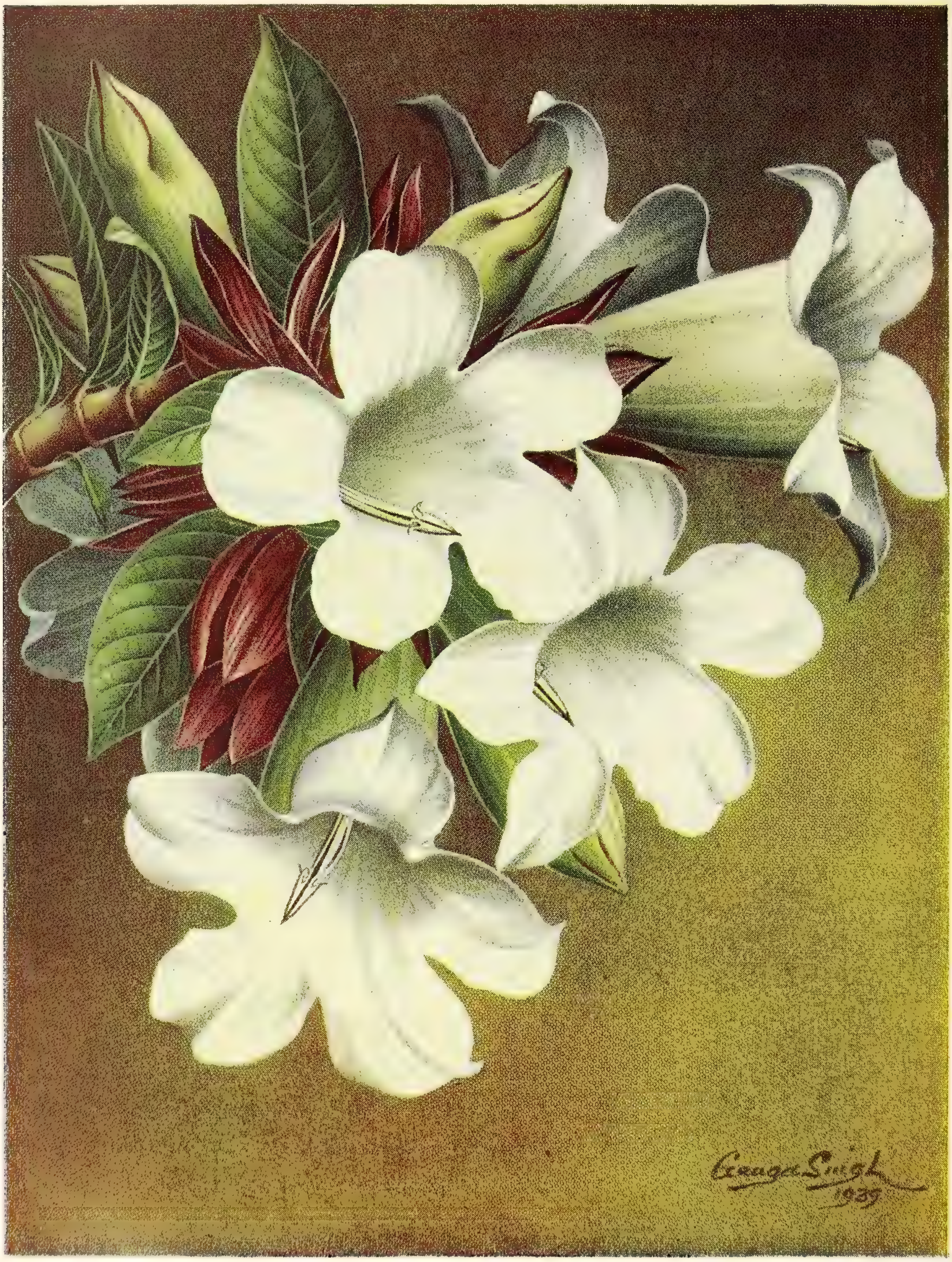
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BEAUMONTIA GRANDIFLORA (Roxb.) Wall.

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SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. BOR, C.I.E., M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

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PART XXI.

[*Continued from* Vol. 45, *No.* 3 (1945), p. 279].

(*With* 1 *coloured,* 4 *black and white plates and* 6 *text-figures*).

Beaumontia Wall.

(This generic name commemorates the name of Mrs. Beaumont of Bretton Hall, Yorkshire, England).

A genus of tall, climbing shrubs. Leaves rather large, opposite, coriaceous. Inflorescence of terminal cymes; flowers large, white, fragrant; bracts often foliaceous. Calyx of five large, foliaceous sepals, glandular or not within. Corolla white, shortly tubular below, widely campanulate above, 5-lobed, lobes twisted. Stamens 5, inserted at the base of the campanulate portion of the corolla; anthers sagittate at the base, connivent around the stigma. Disk present. Ovary of two carpels; style filiform. Fruit of two follicles; seeds compressed ending in a tuft of hair.

MAR 13 '46

Beaumontia grandiflora (Roxb.) Wall.

(*Grandiflora* means large-flowered in Latin).

Description.—This species is a huge evergreen climber which ascends to the tops of the tallest trees in its home, Assam, and covers the crown of its support with its beautiful foliage and flowers. The stem is woody with rusty pubescent shoots, and in old plants reaches a considerable thickness. The leaves are opposite, exstipulate, membranous to coriaceous in texture, ovate to ovate-oblong in shape, smooth and glabrous, rarely sparsely hairy beneath; nerves 7-16 pairs, arching and forming loops within the margin; reticulation prominent beneath; petiole $\frac{1}{2}$-1 in. long, sometimes especially in young leaves, rusty pubescent. Inflorescence a terminal cyme, few- to many-flowered. Bracts large and leafy. Calyx of five oblanceolate, obovate or lanceolate, acuminate segments, often glandular within, 1$\frac{1}{2}$ in. long, dark red, or reddish brown in colour.

Corolla 3-5 in. long, campanulate from a very short tubular base, with five large, rounded, acute lobes about 1 in. long, of a beautiful, pure white or cream colour, greenish towards the base without, glabrous or hairy. Stamens five, inserted on the corolla at the top of the tube, alternate with the lobes, anthers sagittate $\frac{1}{2}$-$\frac{2}{3}$ in. long, connivent to the stigma by their inner surfaces forming a five-sided cone, the stamens and style lying along the inner surface of the corolla. Ovary superior, seated on a five-lobed disk, 2-celled, with many ovules in each cell. Style filiform, expanding above into a fusiform stigma to which the anthers adhere. Fruit long, thick, woody, eventually dividing into two horizontally spreading follicles. Follicles turgid, fleshy, green, with a thick, hard, spongy, yellowish endocarp. Seeds many, compressed, ovoid or oblong, contracted at the top, $\frac{3}{4}$ in. long, crowded, with a coma of hairs 1$\frac{1}{2}$ in. long.

Flowers.—March-April. *Fruits.*—Cold season.

Distribution.—Native of the Eastern lower Himalayas now frequently cultivated in gardens throughout India.

Gardening.—A huge and truly magnificent climbing shrub with large, white fragrant, trumpet-shaped flowers. It is of very rapid growth and ascends to the height of a lofty tree in no time. Propagated by seed, cuttings or layers.

Economic uses.—The young branches are sometimes used for making coarse ropes.

Chonemorpha G. Don.

A genus of high-climbing shrubs. Leaves opposite, broad, with distant nerves. Inflorescence paniculate, terminal or axillary. Calyx-tube cylindrical with an annular glandular area at the base inside. Corolla-tube cylindrical, slightly narrower at the base, ending above in five large twisted petals, horizontally spreading. Stamens five, epipetalous, connivent into a cone and adhering to the stigma, sagittate at the base. Carpels two, distinct; style filiform; stigma thick. Fruit of 2 follicles.

Chonemorpha macrophylla G. Don.

(*Macrophylla* means large-leaved).

Description.—A scandent shrub capable of overtopping the largest trees; stems more or less pubescent, emitting quantities of a white latex if wounded. Leaves opposite, up to 10 in. long and as much broad, ovate, obovate or even orbicular in shape, rounded or cordate or even cuneate at the base, dark green above, paler beneath, almost hirsute below, sparsely hairy above, entire on the margins; petiole short, cylindrical.

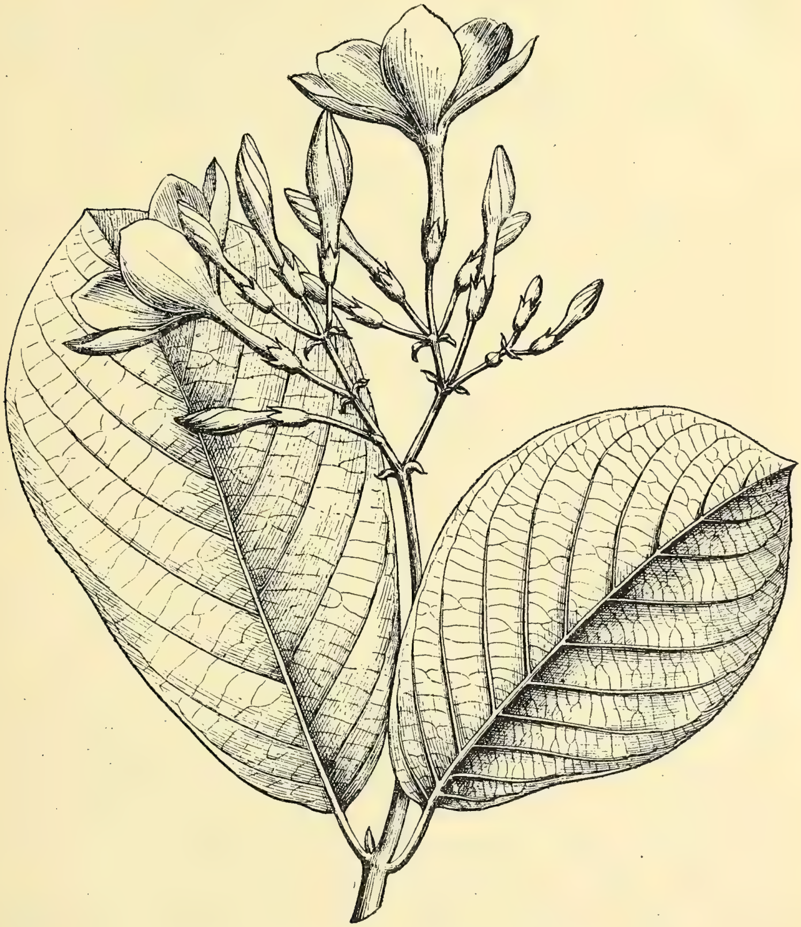


Fig. 1.—*Chonemorpha macrophylla* G. Don. × $\frac{3}{4}$

Flowers borne in sub-terminal short-pedunculate cymes; branches cylindrical, green, speckled with red. Calyx-tube .75 in.

long, cylindrical, shortly 5-lobed, at length withering red-brown and tightly embracing the base of the corolla tube. Corolla-tube white, narrow at the base, swelling above into a throat, about .75 in. long, ending above in five white petals which spread at right angles to the tube; lobes broadly obliquely triangular or trapezoid from a very narrow base, white, yellowish in the throat. Stamens five, inserted at the bottom of the throat. Disk 5-lobed. Ovary of two distinct carpels. Fruit of two long straight hard trigonous follicles 12-18 in. long. Seeds flat with a long tuft of hair.

Flowers.—May-July. Fruits cold season.

Distribution.—Throughout India 2,000-6,000 ft. extending to Burma, Malaya and Ceylon.

Gardening.—A large powerful climber with copious milky juice and very large leaves. The fragrant, pure white flowers, about 3 in. across, appear in great abundance during the hot weather. Propagation is by seed which is produced abundantly. It is suitable for cultivation in the open on a long trellis or on trees.

Vallaris Burm.

(This name is derived from the Latin word *vallo,* I enclose, owing to the fact that some species are used for screens in Java).

A genus of climbing shrubs with punctuate, opposite leaves. The white flowers are borne in dichotomous or fascicled cymes issuing from the axils of the leaves. Calyx 5-lobed, from a short tube. Corolla-tube short, with five petals. Stamens five, fixed to the top of the tube seated on short filaments; anthers acuminate and sagittate at the base, connivent at the apex into a cone, with a large gland on the connective. Disk of five scales or lobes. Ovary of two hairy carpels, at first connate, soon free. Fruit of two oblong acuminate carpels.

Vallaris Heynei Spreng. [*Vallaris solanacea* (Linn.) O. Ktze.].

(This plant was named in honour of Frederick Adolf Heyne, a German botanist who lived at the beginning of the nineteenth century).

Description.—A hoary, climbing shrub or creeping over the soil. Stems covered with a grey lenticellate bark, emitting a copious white latex when wounded. Leaves opposite up to 5 in. long by 2 in. broad, elliptic, oblong, acuminate, sometimes somewhat abruptly narrowed to the acute apex, membranous, cuneate at the base; nervation rather obscure; petiole up to .75 in. long, slender, channelled above.

Inflorescence of axillary cymes about 1 in. long, 3-6-flowered; flowers white, fragrant, seated on slender pedicels. Calyx-tube very short, 5-lobed; lobes up to 1 in. long, acuminate, thin, shortly ciliate on the edges. Corolla-tube about .3 in. long, narrow and cylindrical and hairy within below, campanulate above, ending in five petals, which are orbicular in shape, .25 in. long. Stamens five, inserted at the top of the narrow portion of the tube;

anthers acuminate above, sagittate at the base; carrying a large horse-shaped appendage on the connective. Disk annular, 5-toothed. Ovary of two connate carpels. Fruit of two follicles, straight.

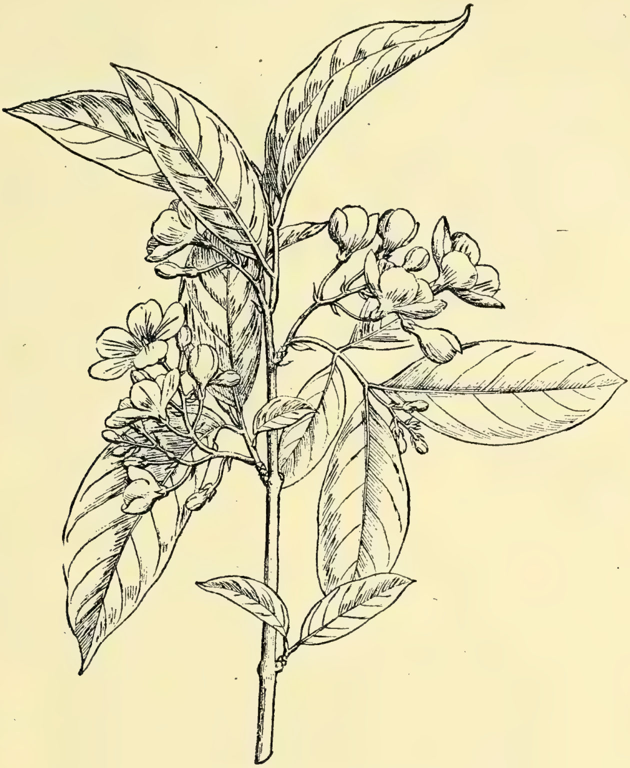


Fig. 2.—*Vallaris Heynei* Spreng. ×¾

Flowers.—December-April. *Fruit* January-April next year.

Distribution.—Native of India and Burma, often grown for ornament in gardens.

Gardening.—An extensive, vigorous climber, evergreen and drought-resistant, with small elliptic-ovate leaves. The creamy white, scented flowers are produced in profusion during December-April. It is an excellent plant for cultivation in the open on trellis, or arches or trees. Propagated easily by layering, cuttings, suckers or seed. It was brought into cultivation in Europe in 1818.

Medicinal and economic uses.—The bark is bitter and astringent and according to Haines is chewed by Kols for fixing loose teeth. The latex from the stem is applied to sores and wounds. According to Rev. Thompson it is believed to keep away snakes during the rains when it is suspended from the roof on a certain day in June.

Strophanthus DC. (*Roupellia* Wall. et Hook.).

(This generic name comes from two Greek words which mean *twisted cord* and *flower* and refer to the long, caudate petals of some species. The other generic name *Roupellia* was selected by Wallich and Hooker to commemorate the name of Charles Roupell of Charlestown, South Carolina, 'commemorated in many of the pages of Sir James E. Smith's Correspondence of Linnaeus'.)

This genus contains a number of shrubs, some of them are climbers. The leaves are opposite and penni-nerved. The inflorescence is terminal and consists of few-flowered cymes, compact, or many-flowered corymbs. Sepals five in number with 5-20 glands at the base. Corolla-tube short, campanulate in the throat, ending above in five petals which are more or less long caudate; throat with 10 scales inserted in pairs. Stamens five, attached to the top of the tube, included; filament short; anthers sagittate, more or less acuminate, connivent. Disk absent. Ovary of two distinct carpels; style filiform. Fruit of two follicles.

The seeds of the species of this genus are well known for the presence of an active chemical substance called strophanthin. It raises the blood pressure, acts as a diuretic and is a powerful cardiac poison. Because of these properties different species have been used as arrow poisons in different parts of the world.

Strophanthus gratus Franch.

Cream-fruit.

(*Gratus* is a Latin word meaning pleasing).

Description.—A handsome, climbing, shrubby plant. Shoots green, terete, very glabrous. Leaves opposite, petiolate, stipulate, up to 6 in. long by 2 in. broad, oblong-elliptic or elliptic in shape, glabrous, entire on the margins, acute at the tip, cuneate at the base, dark green on the upper surface, paler below; nerves somewhat impressed on the upper surface, slightly prominent below, joined by an intramarginal vein; stipule short, awl-shaped; bases of the petioles joined by a stipular line.

Inflorescence terminal, of 6-8 white, rose-tinted flowers, crowded into a cyme. Bracts ovate-lanceolate, acute or acuminate, keeled on the back, .15-.2 in. long. Pedicels longer than the bracts but shorter than the calyx. Calyx of five lobes, each .6-.8 in. long, obovate in shape, obtuse, greenish but reddish at the tip. Corolla-tube swelling above, glabrous without and within, 1.5 in. long, ending above in five petals; petals broadly obovate in shape, crisped on the margins, under 1 in. long. In the mouth of the flower is a corona of 10 linear-lanceolate scales, connate at the base, erect, of a beautiful rose colour, .4-.5 in. long. Stamens five, inserted at the beginning of the swollen portion; filaments short, thick, slightly papillose; anthers produced above into a subulate process protruding from the corolla tube. Ovary surrounded by

Photo by M. B. Raizada.

Cream Fruit

Strophanthus gratus Franch.

New Forest, Dehra Dun.

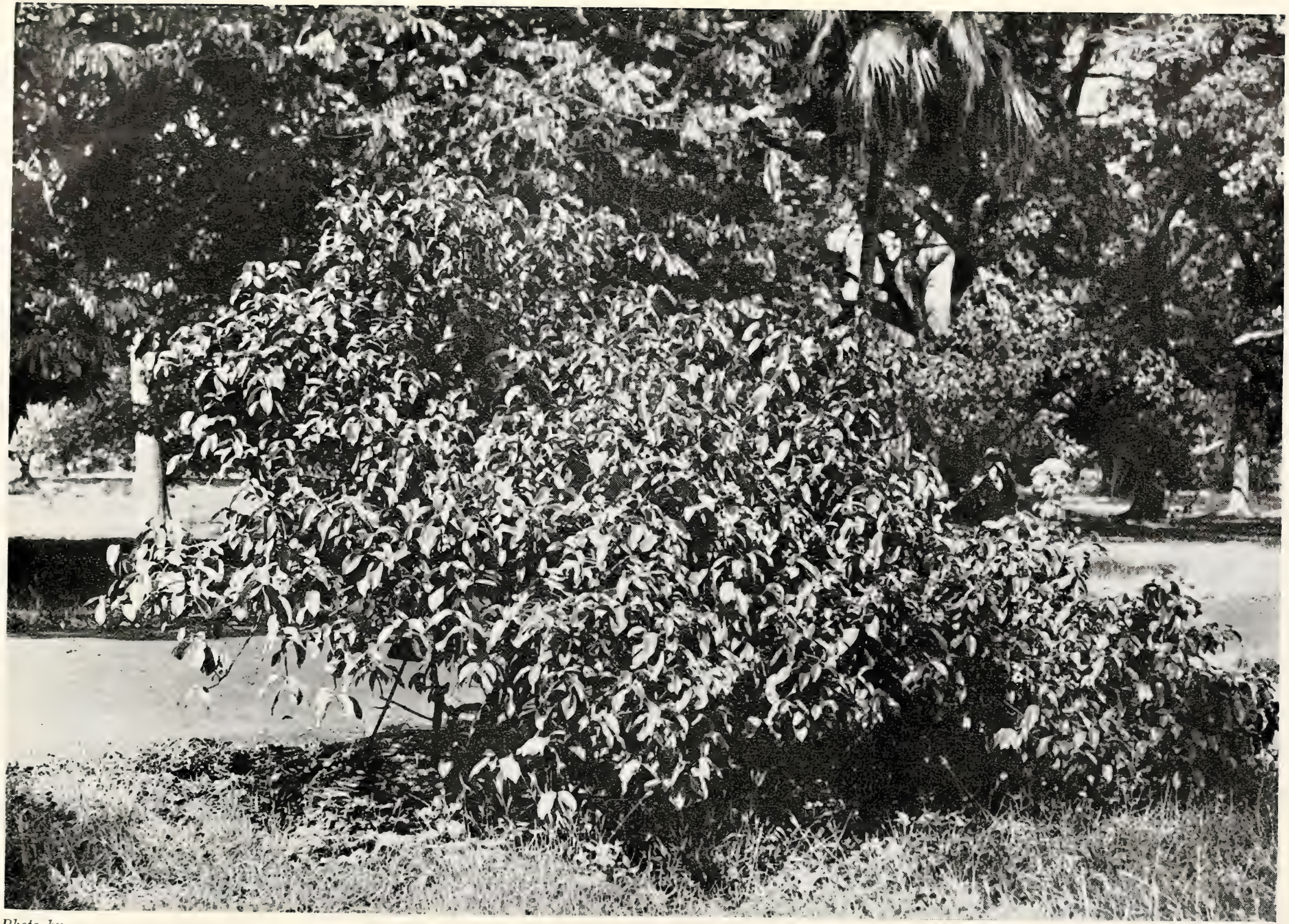


Photo by M. B. Raizada.

CREAM FRUIT

Strophanthus gratus Franch.

New Forest, Dehra Dun.

a nectariferous disk. Carpels distinct, joined by a filiform style; ovules numerous, on axile placentas.

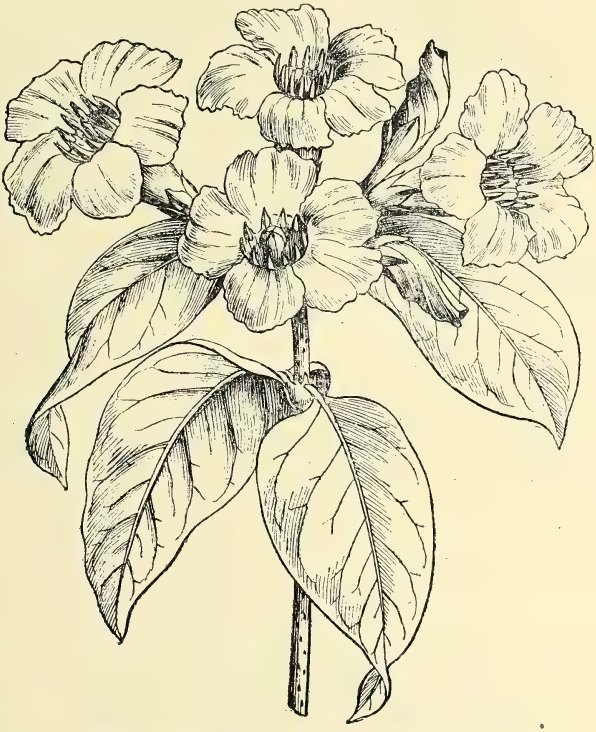


Fig. 3.—*Strophanthus gratus* Franch. × $\frac{3}{4}$

Flowers.—Hot and rainy season. *Fruits* cold season, but very rarely.

Distribution.—Native of Sierra Leone, tropical Africa, now in cultivation in all tropical and subtropical countries of the world.

Gardening.—A handsome, climbing, shrubby plant or a rambling shrub requiring considerable space for its full growth but it can be kept within bounds by judicious pruning. The large, leathery, bell-shaped flowers are white tinged with rose-purple and are attractive just as they are opening. As it is a fast grower it requires plenty of water during summer. Good fresh loam, with a little leaf-mould suits it best. It is well adapted for a trellis or to train up a pillar or rafter. Propagated easily by cuttings which strike root readily during the rains. It is commonly known under the name of *Roupellia grata* in Indian gardens.

Trachelospermum Lemaire.

(This generic name comes from two Greek words, *trachelos*, a neck, and *sperma*, a seed. The combination refers to the long seed of the species.)

A genus of climbing shrubs with opposite leaves. Inflorescence of terminal or axillary cymes. Flowers white or purple. Sepals 5, small, glandular or scaly at the base inside. Corolla-tube cylindrical, dilated at the insertion of the stamens, ending above in five spreading lobes. Stamens five, included in the tube, connate at the apex and connivent around the stigma. Disk annular, truncate, or 5-lobed. Ovary of two distinct carpels. Fruit of two dry follicles.

KEY TO THE SPECIES.

Calyx-lobes erect	... *T. fragrans.*
Calyx-lobes reflexed	... *T. jasminoides.*

Trachelospermum fragrans Hook. *f.* [*T. lucidum* (Don) K. Schum.].

Description.—An evergreen, twining shrub. Young shoots slightly hairy, emitting a milky juice when cut. Leaves opposite, up to 6 in. long by 2 in. broad, elliptic-lanceolate, acuminate, glabrous, bright green above, paler below; petiole about .2-.4 in. long, minutely hairy.

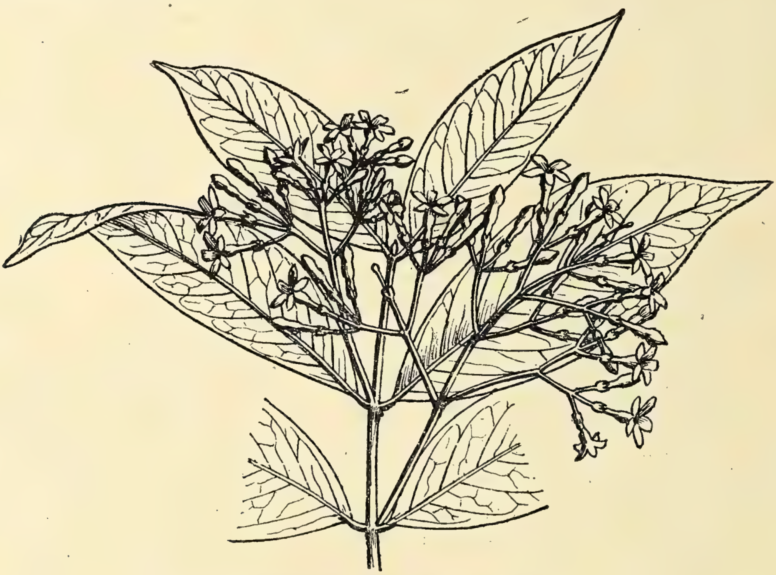


Fig. 4.—*Trachelospermum fragrans* Hook. *f.* $\times\frac{3}{4}$

Inflorescence a lax, terminal or axillary, trichotomous panicle. Flowers white, seated on glabrous pedicels decorated by minute bracts. Calyx about .1 in. long, cleft almost to the base, 5-lobed; lobes ovate, obtuse, ciliate. Corolla-tube about .4 in. long, very slender below, inflated at the top, glabrous within and without; mouth thickened, hairy, 5-lobed; lobes spreading, cuneate below, obliquely truncate at the apex, overlapping to the right, twisted

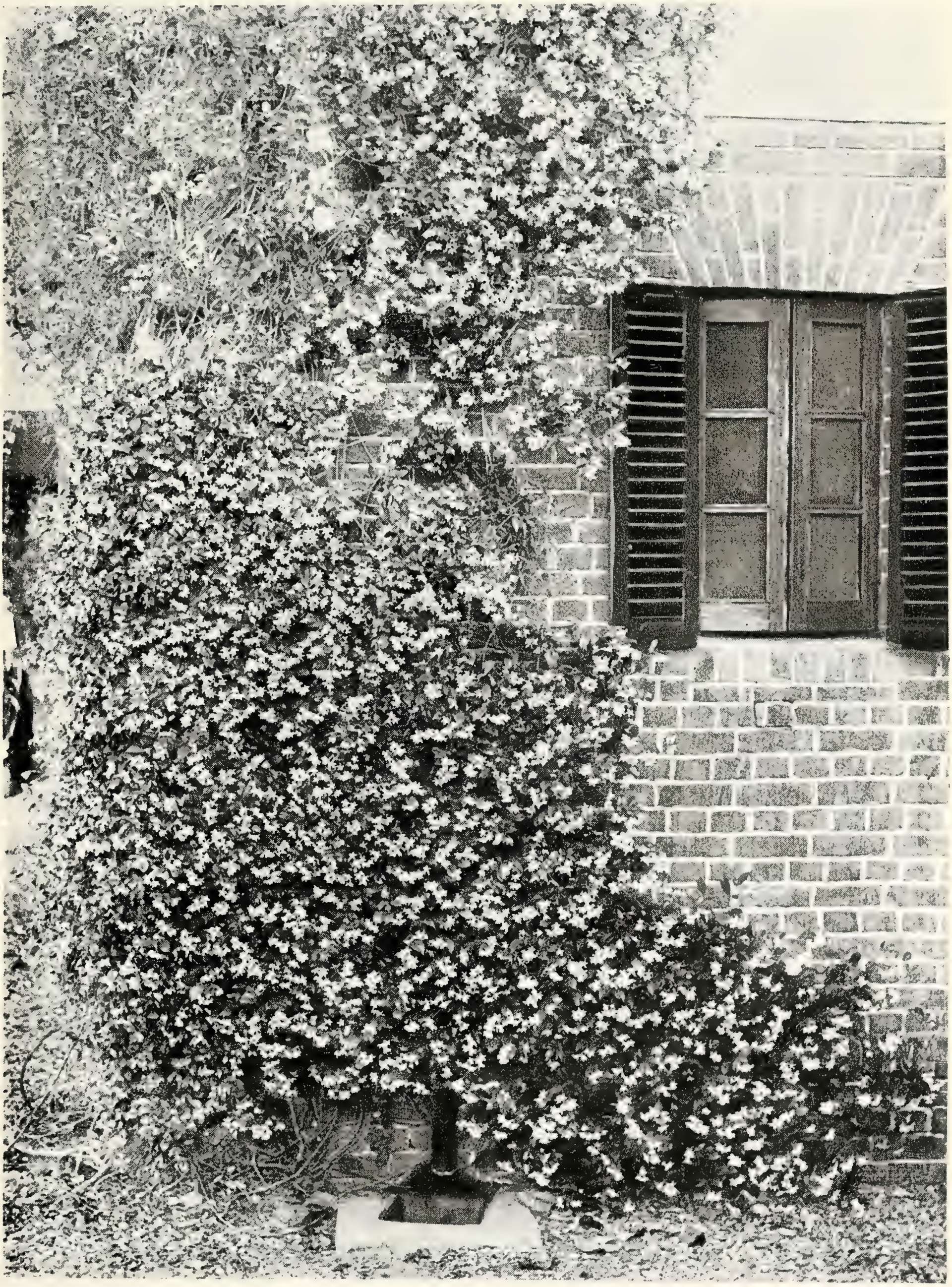


Photo by N. L. Bor.

Hill Jassmine

Trachelospermum fragrans Hook. f.

New Forest, Dehra Dun.

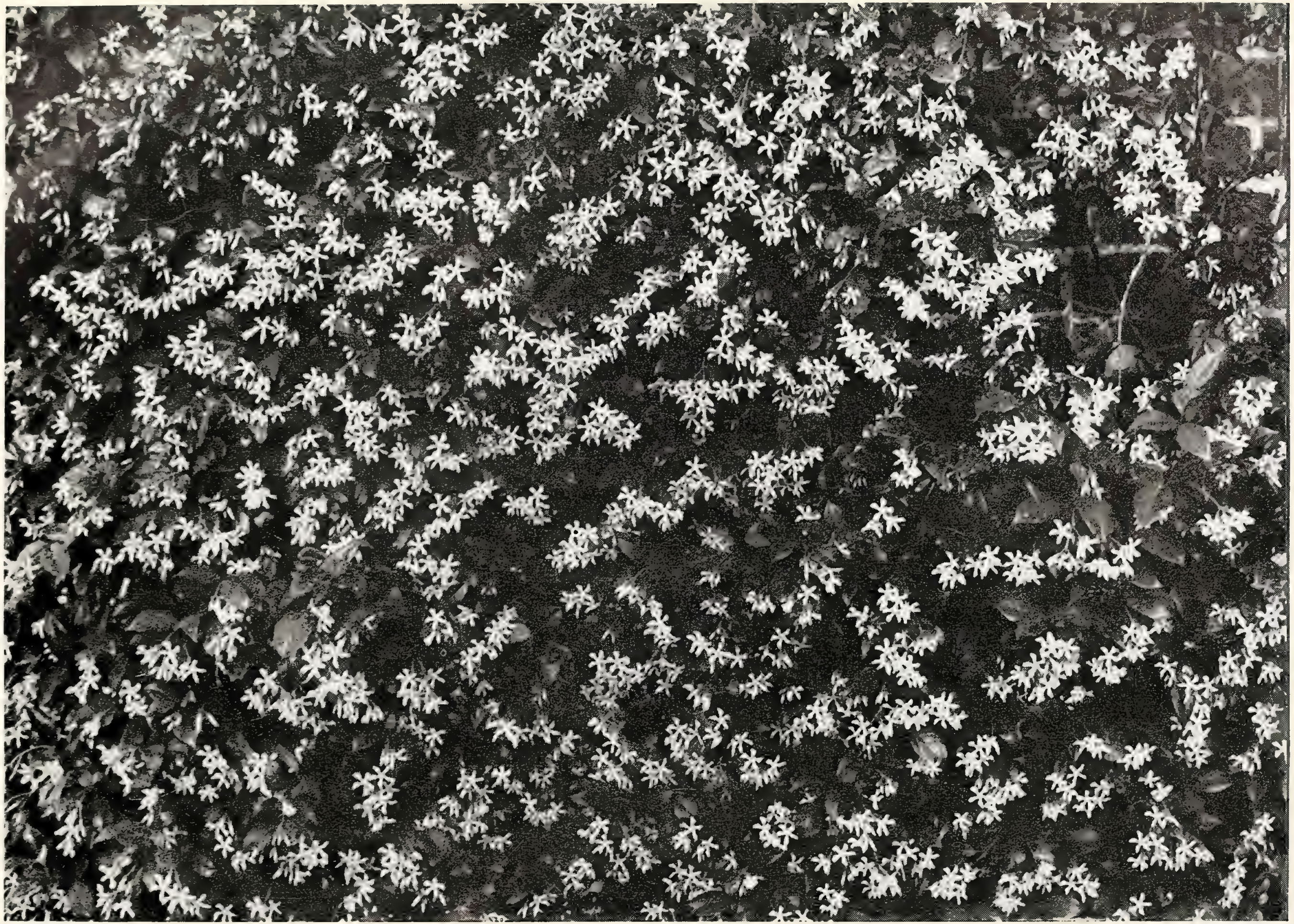


Photo by N. L. Bor.

Hill Jassmine

[illegible]

New Forest, Dehra Dun

to the left. Stamens 5, included; anthers connivent to the top of the style. Disk of 5 erect lobes. Carpels two, glabrous, distinct; style filiform; stigma columnar; ovules many in each cell. Follicles up to 12 in. long by .2 in. broad, incurved, cylindrical. Seeds .7 in. long, linear, flattened, dull-brown; coma copious, 1 in. long.

Flowers.—April-June. *Fruits* October-December.

Distribution.—North-West Himalayas 3,000-7,000, Assam, Cachar, and Upper Burma.

Gardening.—A tall climber with dark green leaves and white fragrant flowers which are produced in great abundance during the hot season. It is suitable for covering embankments and the like and prefers moist shady places. Propagation is by cuttings of half-ripened wood during the rains or by seed.

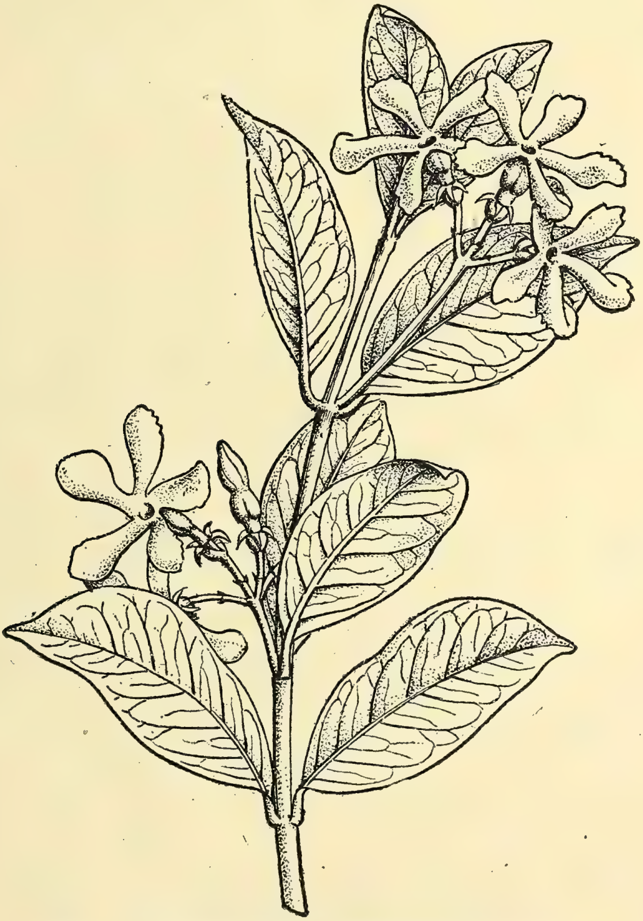


Fig. 5.—*Trachelospermum jasminoides* Lem. ×1/1

Trachelospermum jasminoides Lem.

[*T. divaricatum* (Thunb.) K. Schum.].

Star Jessamine.

(The specific name *jasminoides* means jessamine-like in Latin).

Description.—A pretty, evergreen, climbing shrub; young parts puberulous. Leaves petioled, opposite, elliptic, elliptic-lanceolate or even oblanceolate in shape, glabrous and smooth, somewhat coriaceous in texture, entire on the margins, up to 2.5 in. long by 1 in. wide; petiole very short, grooved above.

Inflorescence a few-flowered cyme seated on a peduncle much longer than the subtending leaf. Flowers pure-white, very fragrant. Calyx divided almost to the base into five reflexed, lanceolate, ciliate segments .1-.2 in. long. Inside the calyx at the base of the corolla are several jagged scales. Corolla-tube .25-.3 in. long, abruptly contracted below the middle, glabrous outside, hairy within at the mouth, ending above in five lobes; lobes oblique, obovate-spatulate, spreading, waved, with reflexed margins. Stamens five, sessile on the corolla; anthers lanceolate; connective produced above into a spur, the whole five stamens connivent into a cone round and adherent to the stigma. Ovary of two carpels. At the base of the ovary are five large glands, two united, three free.

Flowers.—March-April. *Fruits* cold season.

Distribution.—Indigenous to China and Japan, commonly grown in gardens throughout the country.

Gardening.—A pretty, white-flowered, evergreen climbing shrub with deep green, smooth foliage. The delightfully fragrant flowers are produced in great profusion during the early part of the hot weather. It is well suited for growing over a trellis. It was collected by a Mr. Fortune from Shanghai and introduced by him into European gardens. Propagation is by cuttings or layers during the rains. It is best suited for pergolas, arches and the like.

Melodinus Forst.

Climbing shrubs. Leaves opposite, penni-nerved; nerves parallel. Inflorescence terminal of trichotomous panicles, many-flowered or axillary and then few-flowered; flowers white, often fragrant. Calyx of 5 sepals, without glandular scales. Corolla-tube dilated at the insertion of the stamens, ending above in five twisted petals; throat of the corolla furnished with scales. Stamens five, inserted towards the base or in the middle of the tube. Disk absent. Ovary entire, bilocular, style short; stigma thick; ovules numerous. Fruit globular, pulpy, containing many seeds.

Melodinus monogynus Roxb.

(*Monogynus* means with a single ovary).

Description.—A large, glabrous, scandent shrub. Branches and branchlets at first green, afterwards turning brown, containing copious quantities of latex. Leaves opposite, petiolate, up to 6 in.

long, elliptic, elliptic-oblong or oblong-lanceolate, acuminate, glabrous and smooth, chartaceous in texture; margins incurved; petiole .2-.4 in. long.

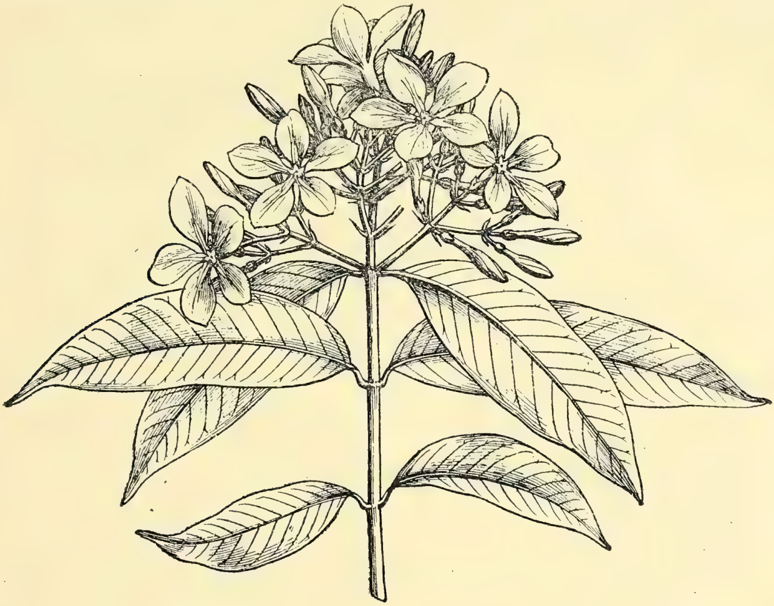


Fig. 6.—*Melodinus monogynus* Roxb. × $\frac{3}{4}$

Inflorescence close, terminal, of trichotomously branched panicles; branches puberulous, rather thick. Flowers white fragrant. Calyx of five sepals, elliptic-obtuse, elliptic-oblong or even ovate, ciliate on the margins, .1-.15 in. long, imbricate. Corolla-tube .7 in. long, tubular below becoming funnel-shaped above, glabrous without but hairy within, ending above in 5 lobes; lobes spreading, up to .5 in. long, oblong or ovate, obtuse; corona of scales present, five in number, villous, bifid at the apex. Stamens five, filaments very short; anthers without basal appendages. Disk absent. Ovary of two connate carpels. Fruit a globose berry, smooth, yellow or orange in colour, up to 3 in. in diameter.

Flowers.—April. *Fruits* cold season.

Distribution.—Native of Sylhet and Assam extending to Malaya Peninsula and China. Occasionally cultivated in gardens throughout the plains and up to 4,000 ft. in the hills.

Gardening.—A large climber with milky juice and bright dark-green, lanceolate leaves. The pure white, very fragrant flowers are produced during spring and make this plant very ornamental. The fruit which is the size and colour of an orange is said to be edible. Propagation is by seed, cuttings or layers during the rains. It was introduced into England by Capt. Craigie as a present from Dr. Wallich of the Calcutta garden. It is well suited for growing over arches, pergolas and the like.

(*To be continued*).

MATERIALS FOR THE ORNITHOLOGY OF AFGHANISTAN.

BY

HUGH WHISTLER (Deceased).

PART V

[*Continued from Vol.* 45, *No.* 3 (1945), *p.* 302].

Columba palumbus casiotis (Bonaparte).

Specimens collected.—sex? Bharowal (Griffith); ♂ 15 March 1879 Kandahar (St. John); ♀ 22 April 1879 Byan Khel (Wardlaw-Ramsay); ♂ 22 Oct. 1934 Ashraf 4,000 ft. (Maconachie).

Wardlaw-Ramsay found the Eastern Woodpigeon in the Hariab Valley 7,000-8,000 ft. in flocks varying from ten to fifty individuals. Throughout April a large flock could always be found in the pine-forest between the main range of the Safed Koh and the village of Ali Khel. These paired by the middle of May and several nests were found.

According to his Journal, Griffith's specimen was obtained at Bharowal on 7 March 1840.

St. John and Swinhoe say that the Woodpigeon is very common in the large gardens about Kandahar.

Columba oenas Linnaeus.

Specimens collected.—♂ 2 ♀ 28 Nov. 1884 Karabagh (Aitchison).

These, the only records of the Stock-Dove in Afghanistan, suggest that it is a winter visitor.

Columba eversmanni Bonaparte.

Specimens collected.—sex? Bharowal Soorgunge near Chughur Serai (Griffith); 2 ♂ 3 ♀ 22-23 April 1885 Tirphul, 2 ♂ 28 April 1885 Tomam-aghi (Aitchison); sex? 1 June Min Darakht, Maimanah (Yate); 2 ♂ 2 ♀ 7-10 May Danaghori 2,300 ft., 2 ♂ 20 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

Commenting on his series of Eastern Stock-Doves in the above list, Aitcheson says that they were nesting in trees in the bed of the Hari-Rud river in considerable numbers. Meinertzhagen first met with this bird at Danaghori where it was quite common, often feeding in the cultivation and marsh-land with the Rock-Pigeon but segregated in its breeding area, the groves of mulberry and old stubs. Birds were flushed from holes in the trees and their organs were ripe for breeding in the second week of May. They were common also at Haibak but outnumbered by the Rock-Pigeon. At Kunduz they were common and breeding, the Rock-Pigeon being then in a minority. At Kunduz they were breeding also in ruined buildings. Six out of fifteen birds shot by Meinertzhagen's party had had their tails recently pulled out, the new feathers being then in growth.

In Seistan, Cumming only saw a single specimen and that he procured at Kuhak on 28 April 1905.

Columba livia gaddi Zarudny & Loudon.

Specimens collected.—♀ Khorsa (Griffith); ♀ 30 Dec. 1880, ♀ 4 Jan. 1881, ♂ 20 March 1881 (Swinhoe); juv. 30 Jan. 1881 Kandahar (St. John); sex? 22 Feb. Chahar Shamba (Yate); sex? December Lab-i-Baring, ♀ 22 April 1905 (Annandale); ♂ 27 August 1933 Logar 5,700 ft. (Maconachie); ♂ 16 April Ghorband 9,000 ft., ♂ 19 April Balula 8,000 ft., 2 ♂ 20 April Bamian 9,000 ft., ♂ 26 April Akrobat, 3 ♂ 2 ♀ 12 May 1937 Haibak 3,000 ft. (Meinertzhagen).

The hybridisation of the Blue Rock-Dove with the domestic pigeon appears to have reached its apogee in Afghanistan and all writers comment on this fact and the varieties of plumage to which it gives rise. Wardlaw-Ramsay found them common in the Hariab Valley 7,000-8,000 ft. in May and June and attributes their great variation of plumage to hybridisation. Yate (Northern Afghanistan, p. 46) has the following interesting note:—'The nearer one gets to Herat the thicker the pigeons become and the villages round the city simply swarm with them. The fields are alive with flocks but woe to the man who shoots them as they are all considered private property and a regular source of income. The round towers at the corners of the villages are generally made into pigeon houses in addition to the regular square-built pigeon towers that one sees dotted about the country. The birds have to be fed throughout the country or otherwise they go off to a more hospitable place as it is the object of every owner to tempt as many birds as possible to take up their residence in his particular tower for the breeding season. A large tower, it is said, will produce as much as 15 kharwars (1 kharwar = 10 maunds Indian) of manure in a year and the ordinary round bastion-shaped tower at the corner of a village produces at least 6 or 7 kharwars. Each kharwar sells at the rate of 15 krans or 6 rupees.'

The Rock-pigeon is found in Seistan (Cumming) and St. John notes that enormous flocks occur everywhere at Kandahar in winter. They commence nesting early in March. Both St. John and Swinhoe discuss the variations in plumage and their connection with tame stock.

The above summary was written before Meinertzhagen's account appeared with which it has little agreement. He says that domestic pigeons are not very usual in Afghanistan and he saw no evidence of feral birds. His account of what he considered truly wild stock is as follows:—'The Rock-pigeon is apparently resident throughout Northern Afghanistan up to at least 9,000 ft. in suitable localities. At Danaghori they were in about equal numbers with *Columba eversmanni*, at Haibak the latter was in a minority, but at Kunduz *eversmanni* predominated. They were often in small mixed parties and did not appear to compete one with another. Though *eversmanni* occasionally nests in banks and buildings (never in cliffs), the usual nesting site is a hole in a tree, a situation never used by Rock-pigeons.

The largest colony of Rock-Pigeons we saw was at Bamian, where they had taken advantage of human excavations and were breeding in numbers on the Buddhas and in the rock-dwellings.'

The two accounts, of course, refer to different areas and are divided by a number of years so there is not much point in discussing how they may be reconciled. Both grey-rumped and white-rumped birds occur throughout the country. Afghan birds have hitherto been attributed to *intermedia* or *neglecta* but Meinertzhagen who has had the best series for examination attributes his specimens to the Persian race *gaddi* and Swinhoe's and St. John's specimens which I have seen would I think pass as that form.

Streptopelia turtur arenicola (Hartert).

Specimens collected.—2 ♂ 1 ♀ 12 May 1885 Khusan (Aitchison); sex? 2 July Chilik, Afghan Turkestan (Yate); ♀ 4 July 1933 Ashraf Valley 3,700 ft. (Maconachie); 2 ♂ 1 ♀ 8 May Danaghori 2,300 ft., ♀ 20 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

Aitchison states that the Common Turtle-dove suddenly arrived on the Hari-Rud in large flocks about 12 May. Meinertzhagen first met with them at Danaghori on 8 May where they were common and had just arrived. By 10 May, they were still more abundant and pairs were courting and evidently preparing to breed. They were equally abundant at Haibak and Kunduz from the second week in May and on the return journey they were common at Doshi on 22 May. Maconachie obtained a female in the Ashraf Valley on 4 July 1933.

This Turtle-dove evidently does not breed in Southern Afghanistan as the only record is afforded by a specimen Colonel Swinhoe is said to have obtained at Kandahar. I have not been able to trace it.

Streptopelia orientalis meena (Sykes). [=*ferrago* auct.].

Specimens collected.—sex? 23 May, ♂ 5 June 1879 Byan Khel (Wardlaw-Ramsay); 2 ♂ 1 May Doshi 2,750 ft., ♂ 13 May Haibak 3,000 ft., ♂ 24 May 1937 Ghorband 8,300 ft. (Meinertzhagen).

'First met with at Doshi, when four birds were seen feeding on fallow land. Their organs were ripe for breeding. Again at Haibak on 12 May a single pair was found in the mulberry orchards, another pair at Baghlan on 18 May and several pairs were found breeding in the Ghorband Valley at about 8,000 ft. on 24 May where they were absent in mid-April' (Meinertzhagen).

Apart from the above records, which incidentally confirm the correctness of keeping *orientalis* and *turtur* as separate species, the Eastern Turtle-Dove is only recorded from the Sufed Koh where Whitehead says it is common in summer in the woods from 7,000 ft. to tree limit. There Wardlaw-Ramsay says they arrived at Byan Khel 7,000 ft. in large numbers between 12 and 26 May.

Streptopelia senegalensis ermanni (Bonaparte).

Specimens collected.—2 ♂ 14 May 1937 Haibak 3,000 ft. (Meinertzhagen).

Meinertzhagen met this race of the Little Brown Dove at Haibak where it was breeding in buildings in mid-May. He also observed it at Kunduz on 20 May, where there were a few about the old ruined town.

Streptopelia senegalensis cambaiensis (Gmelin).

Specimens collected.—♂ 10 March 1879 Kandahar (St. John); ♂♀ 19 March 1881 Kandahar (Swinhoe); ♀ 11 June 1933 Logar 5,700 ft. (Maconachie); ♂ 31 May 1937 Jalalabad (Meinertzhagen).

Meinertzhagen found the Little Brown Dove breeding commonly at Jalalabad on 31 May, on which day a nest with eggs was found. He also observed it as far west as Nimla; and Maconachie obtained it at Logar on 11 June. It is presumably a resident in this area as it is in Southern Afghanistan where St. John and Swinhoe found it common. It commences breeding at Kandahar in the latter end of February and is very common in the city, nesting in holes in the mud walls.

Streptopelia chinensis suratensis (Gmelin).

Nobody has obtained a specimen of the Spotted-dove in Afghanistan but it is recorded by Hutton who says it is common during the summer at Kandahar. Meinertzhagen observed it at Nimla and Jalalabad on 31 May but says it was not common.

Streptopelia decaocto decaocto (Frivalsky).

Specimens collected.—2 sex? Chughar Serai, sex? Khursak, 2 ♂ Kabul, sex? Kandahar (Griffith); ♂ 7 May 1879 Kandahar (St. John); ♀ 15 Dec. 1880, ♀ 14 April 1881 Kandahar, 2 ♂ 1 May 1881 Gungazai (Swinhoe); ♂ 7 May 1905 Khwaja Ahmed (Cumming); ♂ 17 May 1933 Kabul (Maconachie).

Wardlaw-Ramsay found the Indian Ring-dove not nearly as abundant as *S.d. meena* in the Hariab Valley 7,000-8,000 ft. He first observed it there on 10 June. At Kandahar, according to Swinhoe, it is common throughout the year, avoiding the city and being found in the surrounding gardens. Nests were being built in April. It must be fairly widely distributed in the country, as besides the localities provided by the above listed specimens, Meinertzhagen found a pair breeding in the Legation garden at Kabul on 25 May. He also observed it on the Upper Kabul River near the Unai Pass at about 7,000 ft. in late May and breeding at Jalalabad on 31 May.

Oenopopelia tranquebarica (Hermann).

Meinertzhagen observed several Red Turtle-Doves in the hotel compound at Jalalabad on 31 May. Doubtless a summer visitor.

Pterocles orientalis (Linnaeus).

Specimens collected.—♂ Subzeekote, ♀ Afghanistan, ♂ 13 July 1839 Gojhaur, ♀ 25 Oct. 1839 Kabul (Griffith); ♂ April 1879 Kandahar (St. John); 2 ♂ 1 ♀ 2-20 Jan. 1881 Kandahar (Swinhoe); ♀ 3 Nov. Kin, ♀ 5 Nov., ♂ 6 Nov. Kagin, ♂ 9 Nov. 1884 Karez dasht, ♀ ♀ 12 March 1885 Gulran (Aitchison); sex? 1896 Shorawak (Maynard).

The earliest record of the Imperial Sandgrouse in Afghanistan is provided by Vigne (p. 110) though I cannot quite identify his locality. About 12 June

1836 he was on the plain of Suliman Khel between Ser-i-Koh and Dsharah Ridge and relates how his party frequently disturbed the *boora korra* (black breast) or large Sandgrouse with its gurgling cry. These birds afforded him good sport to the delight of the Lohanis many of whom had never seen anything killed with shot before. These birds must have been on their breeding ground and it is clear that this species is widely distributed as a breeding bird in Afghanistan. As regards South-east Afghanistan, St. John says that a few remain to breed, and Swinhoe adds that they commence pairing early in March, eggs being said to be laid about the middle of April. This is supplemented by C. H. T. Marshall (*Stray Feathers*, vol. viii, p. 492) who says that he has just heard—possibly from St. John—that *P. arenarius* was found breeding in numbers on the Wuzeer Korey plain, about 10 miles from Kandahar. No eggs were taken as the discoverers did not wish to disturb the birds.

In North-west Afghanistan Aitcheson and Yate (p. 45) found them breeding in pairs all over the plains in May and June, the nest being a mere hollow scratched in the ground by the side of a tuft of wormwood. Yate remarks on the excellence of the young birds for the table.

It would seem, however, that the Imperial Sandgrouse is found in greater numbers as a winter visitor or passage migrant. Swinhoe says they are found in the Kandahar area throughout the year, but St. John says that the majority of the immense flocks seen in winter move northwards in the spring.

In the North-east, Yate (p. 45) under 14 Sept. 1885 at camp Robat-i-Afghan says that the Sandgrouse are now appearing in regular flocks and Aitchison also speaks of them occurring in large flocks during autumn and spring.

Koelz (*Proc. Biol. Soc. Washington*, vol. 52, p. 81) would separate Afghan birds as *Pterocles orientalis bangsi.*

Pterocles alchata (Linnaeus).

Specimens collected.—♀ Afghanistan (Griffith); 2 ♂ 18 June, 3 ♀ n.d. Kham-i-ab, Afghan Turkestan (Yate).

Under the description of the 'white-breasted pintail Sandgrouse' Yate mentions meeting the Large Pin-tailed Sandgrouse at Khusan on 12 Oct. 1885 and in May in the desert that lies between Andkhui and the Oxus. In the latter area he says he used to see them coming to drink in small numbers wherever a few inches of mud and water were left. As Yate's specimens were obtained in June it seems safe to assume that this Pin-tailed Sandgrouse breeds in Afghan Turkestan.

St. John considered that it bred in the desert between the Helmund and Kandahar as he met it there in July. He says it is more of a desert form than *arenarius* and in consequence not so generally distributed. At Kandahar Swinhoe says several flocks were about for a week or ten days about Christmas time. He killed five from a passing flock about half a mile in front of the Idghar Gate.

Pterocles coronatus atratus Hartert.

Specimens collected.—2 ♂ Bassoolah 1,500 ft. (Griffith); ♂ 1896 Shorawak (Maynard).

St. John says that the Coronetted Sandgrouse is the only small Sandgrouse of Southern Afghanistan where it is very generally distributed though nowhere numerous. It is commonly seen in small parties of six or so and is more active on the ground than other sandgrouse, running about and picking up seeds like a partridge in contrast with the staid and leisurely movements of *arenarius* and *alchata*. It evidently breeds in the Helmund desert for he found it common between Kandahar and the river in July.

There is no record of it out of this area.

Pterocles senegallus (Linnaeus).

Specimens collected.—♂ 11 March 1896 Lijjikarez 2,400 ft. (Maynard); ♀ 21 Dec. 1918 Lutak Road, Seistan, 1,600 ft. (Annandale & Kemp).

According to Cumming this is said to be the common sandgrouse of Seistan and Annandale & Kemp's bird, which I have been able to examine through the courtesy of Dr. Baini Prashad, is certainly a specimen of the Spotted Sandgrouse though it was recorded as *Pterocles arenarius caudacuta* (sic).

[It is not clear whether the Common Sandgrouse (*Pterocles senegalensis ellioti*) actually occurs in Afghanistan. Hutton certainly says that it is common throughout the southern parts of Afghanistan and that he has seen their nests in August and the young ready to fly by the end of September, but this seems to have been due to confusion with some other species.

It is useless speculating as to the identity of the pair of sandgrouse Wardlaw-Ramsay saw flying over the camp in the Hariab Valley 7,000-8,000 ft. at the same hour in the same direction on three successive evenings.].

Pucrasia macrolopha castanea Gould.

Specimens collected.—2 ♂ Kafaristan.

According to Griffith's Journal the Koklas was brought in to him at Bala Chughar Serai on 9 March 1840.

I can trace no other information about this pheasant in Afghanistan and the above types are, so far as I know, the only specimens at present existing in any collection.

Phasianus colchicus principalis Sclater.

Specimens collected.—2 ♂ 3 ♀ 29 Dec. 1884, 2 ♂ 3 Feb. 1885 Balamorghab, 1 ♂ 2 ♀ 15 Feb. 1885 Karawal Khana, Badghis (Aitchison); ♂ 10 Feb. Chahar Shamba, ♂ 10 March ♂ 20 March ♀ 26 March ♀ 25 March Maruchak, Murghab (Yate).

The first example of this pheasant to reach the notice of a scientist was probably the mutilated specimen sent to Hutton (p. 782) from Herat by Lieut. North of the Bombay Engineers. It was recorded by Blyth under the name of *Phasianus colchicus* and from his description appears to have been an old or barren female in partial male dress.

It remained however for the officers of the Boundary Commission to collect a good series of skins on which the bird was separated as a distinct species by Sclater. The Commission found that the pheasant was extraordinarily numerous in north-west Afghanistan in the swampy tamarisk and grass jungles of the river beds—jungles where the tiger and the wild pig were also found. Kuhsan and Tomam-agha on the Hari-Rud; Kara Tepi in the Kushk Valley; Maruchak, Shukar-Gujar, Karawal Khan, Chahar Shamba, Bokum and Kila Wali, all in or near the Morghab Valley; and Chashm-i-Sher near the Chahar Dar Pass of the Hindu Kush—all these are localities where the birds were found as described by Yate in his 'Northern Afghanistan or Letters from the Afghan Boundary Commission' (pp. 45, 59, 102, 112, 124, 125, 129, 207 and 326) where a good idea is conveyed of the habits and habitat of the bird. It was then sufficiently numerous for 72 birds to be bagged in the best days shooting and more than 400 were killed in the march of 30 miles up the Morghab.

The breeding season is fairly early as Yate states on 2 April that the pheasants were then all breeding, the hens having begun to lay a month previously. It is curious for English readers to learn of this species that 'it not only wades through the water in trying to make from one point of vantage to another, but swims, and seems to be quite at home in these thickets, where there is always water to a depth of two or three feet'. Morning and evening the pheasants fed on the more open and dry country around. The local method of riding down the birds on horseback in the snow and catching them by hand is described by Yate.

Phasianus colchicus bianchii Buturlin.

Specimens collected.—9 ♂ 8 ♀ 4-9 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

'This pheasant was only met with in the marshes in the Danaghori Plains. They also occur at Kunduz in similar country, but probably have no intermediate station owing to lack of suitable country. Birds were laying in the first week of May. . . . The Danaghori pheasants roost and spend the heat of the day in the extensive reed-beds, coming out to water-meadows and crops in the morning and evening. If flushed they at once make for the reeds, and if they find one between them and the marshes they fly back over one's head. Nothing will drive them from their home'. (Meinertzhagen).

This series was identified by Meinertzhagen after comparison with topotypical material in the Leningrad Museum.

Note.—Three pheasants of the *colchicus* group are in the Maconachie collection. Unfortunately they were evacuated from the British Museum before I had examined them or ascertained the data.

Lophophorus impejanus (Latham).

The Monal Pheasant according to Whitehead is fairly numerous on the Sufed Koh from 9,000 ft. to tree-limit. So Wardlaw-Ramsay's informants were right who told him that they had seen the birds on the Safed Koh and the Peiwar Range and that they were plentiful.

Whitehead met young fairly strong on the wing on 27 July.

In 1840 Griffith notes in his Journal that the Monal is not uncommon on all the hills about Bala Chughur Serai, the local name being *Moorgi Zureen.*

Coturnix coturnix coturnix (Linnaeus).

Specimens collected.—2 ♂ 26-27 April Tomam-agha, Hari Rud, ♀ 4 May Tirphul, Hari-Rud, ♀ 21 May 1885 Sang-haji, Badghis (Aitchison); ♂ 4 April Chahar Shamba (Yate); ♀ 19 April Karawal Khana, Murghab, ♂ 6 May Chahar Shamba (Yate); ♀ 22 Sept. 1904 Kuhak (Cumming); ♂♀ 4 May 1934 Bagram (Maconachie); 3 ♂ 22-26 May-April 1937 Bamian 8,500 ft. (Meinertzhagen).

The Common or grey Quail seems to be fairly generally distributed as a breeding bird in Afghanistan. Aitchison says a very few pairs were met with all over Badghis. St. John says they breed in small numbers in cornfields in the Kandahar Kuhak 30 March (1 egg), and Kila-i-Konah on 25 April (10 eggs). Cumming Province. Cumming mentions nests found in 1904 at Zahidan 22 March (1 egg), also implies that a few are found in Seistan in winter. In the main however the bird is evidently a spring and autumn passage migrant evidently in considerable numbers. The spring passage takes place in March, April and May. At Kandahar the Quail arrives in the middle of March according to Swinhoe or the end of March according to Hutton. At Bharowal in 1840 Griffith notes their arrival on 26 April in his Journal. In the north Meinertzhagen did not observe Quail until the night of 20-21 April at Bamian 8,500 ft. when numbers arrived and the local population turned out to noose them. He noted another large influx on 26 April but no more were seen, save for a single bird at Haibak on 15 May.

There is little information about the autumn passage save that it takes place in September and October. Griffith mentions Quail in his Journal as abundant at Bamian from 3 to 6 September, at Zohwak on 6 September, abundant at Kurzar 10 September at the Sorkhab River on 9 October and as scarce at Sultanpur on 20 October.

Quail are commonly kept by Afghans for fighting and in the spring nearly every man and boy is seen with one or two about him, often dancing the bird up and down on the hand to strengthen its legs.

Alectoris graeca (Meisner).

Specimens collected.—2 sex? Bala Chughur Serai (Griffith); 3 ♀ 17 Nov. Khusan, Hari-Rud, ♂ 28 Nov. Kar-o-bagh, ♂ 16 Dec. 1884 Bala Morghab (Aitchison); ♂ 1896 Khwaja Amran (Maynard); ♂ 27 August 1933 Logar 5,700 ft. (Maconachie); ♀ 11 April Tangi Gharo, Kabul 5,500 ft., ♂ 16 April Ghorband 6,000 ft., ♂♀ 27 April Dar-e-shikari 8,200 ft., ♀ 22 April 1937 Bamian 10,200 ft. (Meinertzhagen).

The Boundary Commission found the Chukor very numerous and in large coveys all over north-west Afghanistan from Khusan to Bala Morghab; and Yate (p. 56) gives an appreciative picture of the sport to be obtained when a pack of a hundred or more had been broken up in suitable cover in the bed of the Hari-Rud. He describes the Iskar Valley of the Hindu Kush as similarly swarming with chukor. These numbers have now no doubt been reduced with the general introduction of fire-arms but the bird is apparently still common. Meinertzhagen says it occurs in suitable country round Kabul north to Ghorband, Bamian and Doab but not much further north in spring and summer. In winter it descends and is then common at Doshi, Danaghori and Haibak though it does not seem to breed much below 5,500 ft.

Further to the north-east in Wakhan, Biddulph found the Chukor especially abundant in the valley between Panjah and Sarhad and the local people were then accustomed to hawk them.

The bird is also found in the hills of the south-eastern border and Whitehead says it occurs up to at least 8,000 ft. on the Safed Koh.

Meinertzhagen says birds were laying at the end of May in Afghan Turkestan and Wardlaw-Ramsay obtained a nest in the Hariab Valley on 16 June.

I am not fully satisfied as to the identity of Afghan Chukor and it may well be that more than one race occurs within the political boundaries. Meinertzhagen attributes his series to the race *falki* and Biddulph calls the Wakhan birds *pallidus*, while it seems probable that birds from the south-east should belong to the Persian and Baluch race *koraikovi*.

Ammoperdix griseogularis griseogularis (Brandt).

Specimens collected.—♀ Bala Chughur Serai (Griffith); ♂ 29 May 1879 Kandahar (St. John); ♀ 5 January 1881 Kandahar (Swinhoe); ♂ 8 Nov. 1884 Karez-dasht (Aitchison); ♂ 10 March 1896 desert near Gazechah 2,500 ft. (Maynard); ♂ 5 July 1933 Asraf 3,700 ft. (Maconachie); 2 ♀ 16-17 May Haibak 3,000 ft., ♀ 22 May 1937 Barfak 3,000 ft. (Meinertzhagen).

In his Journal, Griffith says he found the Seesee very common at Jagdulluck and very abundant at Gundamak and he also met it at Futtehabad and Bala Chughur Serai. It is now probably less common in those localities as Meinertzhagen found it decidedly scarce in Northern Afghanistan. In addition to the three specimens procured he only saw a pair at 10,000 ft. in the Bamian Hills on 24 April and another bird at Doab 5,000 ft. on 28 April. Aitchison says the most northerly locality at which he saw it was at Mont Do-Shakt near Kilki.

To the south-east it is found in broken and rocky ground by the hills of the Kandahar area and it was recorded as common by Hutton, St. John and Swinhoe.

Meinertzhagen's specimens were breeding in May.

Francolinus francolinus henrici Bonaparte.

Specimens collected.—♂ Kandahar (Griffith); ♀ 26 Oct. between Padda-Sultan and De-Kamran, ♀ 27 Oct. 1884 between De-Kamran and De-Doda Aitchison; ♀ juv. August 1904 Kuhak (Cumming).

Swinhoe says that a few Black Partridges are to be found in the gardens near Kandahar and one day he shot five over an Irish Setter. He heard the characteristic call at Kokeran on the River Argundab. St. John says it is found in suitable localities throughout the Kandahar province up to 4,000 ft., being very numerous in the tamarisk jungles of the Helmund and among the dwarf palms of That Chotial. Throughout Seistan it is—or was in Cumming's day—an extremely common bird in the extensive tamarisk jungles which cover the banks of the numerous streams. Bags of 28 brace and 22½ brace were killed by Major T. W. Irvine and Capt. R. C. Bell who were with the Mission. Eggs were obtained at Kuhak in April, May and June.

The only specimen I have been able to examine from South Afghanistan is Griffith's Kandahar bird which in my opinion agrees with *F. f. henrici*. Hutton remarks on a Kandahar specimen as pale and so does Annandale with reference to Cumming's Kuhak bird. Ticehurst would however assign these birds to *F. f. bogdanowi* (Zarudny).

The only other area where the Black Partridge is recorded is between Padda-Sultan, De-Kamras and De-Doda. Here numbers were shot by Aitchison's party but only two were preserved. I have examined the De-Kamran specimen which is in the British Museum and consider it very close to *henrici* though the underparts are very pale and lightly marked showing transition to *arabistanicus*.

Tetraogallus himalayensis himalayensis Gray.

Specimens collected.—Sex? Afghanistan (Griffith); sex? 7 Oct. Dhap Darah, Hindu Kush (Yate); ♀ June 1933 Paghman Range (Maconachie); ♀ 21 April 1937 Bamian 10,500 ft. (Meinertzhagen).

The Griffith specimen may have come from Topehee 9,000 ft. where he mentions the species under the date 2 Sept. 1840 in his Journal. Meinertzhagen says two Snowcock were seen hanging in a shop in Kabul on 13 April. They were said to have been killed in the Paghman Hills. In the Ghorband Valley they were heard at 10,000 ft. in mid-April and at Bamian, south of the village, there were a few at between 9,000 and 12,000 ft. in April. Birds were breeding in the third week in April for the bird he shot had a fully-formed shell-less egg almost ready for laying.

Yate (p. 330) relates how the Hindu Kush specimen was caught by a Sowar under a rock where they had seen it take refuge from the pursuit of an eagle. Maconachie's bird was brought alive from the Paghman Range.

The Snowcock also occurs on the Safed Koh where Whitehead found it from about 9,000 ft. to the summit in summer though it was rather scarce.

Rallus aquaticusi korejewi Zarudny.

Specimens collected.—♂ 20 Oct. 1884 between Lundi and Rudbar, ♂ 10 Jan. 1885 Bala-Morghab (Aitchison); sex? 23 Dec. Maruchak, Morghab (Yate); ♀ 10 April 1937 Kabul (Meinertzhagen).

The above specimens provide the only records of the Water Rail in Afghanistan.

Crex crex (Linnaeus).

Specimen collected.—sex? 7 May Maruchak, Murghab (Yate).

Blyth states, apparently on the authority of a Captain Duncan who brought specimens, that the Land-Rail is a common summer visitor to Afghanistan but this presumably applies to the north only.

Porzana porzana (Linnaeus).

Specimens collected.—♂ 10 March 1881 Kandahar (St. John); sex? 9 April Karawal Khana, Murghab, sex? 30 April Chahar Shamba, Maimanah (Yate); ♀ 4 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

In addition to the above records, Blyth says that Barnes procured the Spotted Crake at Kabul and Hutton that it was shot at Kandahar.

Porzana parva (Scopoli).

Specimens collected.—♀ 7 Feb., ♀ 17 Feb., ♂ 18 Feb. 1881 Kandahar (Swinhoe); ♀ 6 Sept. 1904 Kuhak (Cumming).

According to Swinhoe and St. John, the Little Crake is common about the Kandahar marsh and the wheatfields on its borders about February. Cumming's Kuhak specimen was identified by Annandale with some hesitation.

Porzana pusilla pusilla (Pallas).

Specimens collected.—♀ 10 Feb., ♀ 17 Feb. 1881 Kandahar (Swinhoe); ♂ 7 Oct. 1884 between Gaz-i-cha and Safia (Aitchison); 2 sex? 24 April Kila Wali, Murghab (Yate); ♂ 5 April Chaharasia 5,700 ft., ♀ 7 Sept. 1933 Rahkol (Maconachie); ♀ 10 April 1937 Kabul (Meinertzhagen).

The above records supply our information about the Eastern Baillon's Crake in Afghanistan except that Swinhoe says that it is numerous about the Kandahar marsh where Hutton also mentions it.

Gallinula chloropus indicus Blyth.

Specimens collected.—sex? Kabul (Griffith); ♂ 7 April 1879 Kandahar (St. John); sex? Band-i-Seistan (Cumming).

Griffith mentions the Moorhen in his Journal at Shah Bagh on 24 July 1841. It evidently is not common though Blyth mentions it at Kabul, Hutton says it was shot at Kandahar in winter and Meinertzhagen says that it was often heard in the marshes at Danaghori in May.

Porphyrio poliocephalus (Latham).

Specimens collected.—♀ 13 March 1881 Kandahar (Swinhoe); 2 sex? Nov. 1934 hear Kabul (Maconachie).

The main stronghold of the Purple Coot in Afghanistan is in the dense reed-beds of the Naizars of Seistan where it is numerous though seldom seen. Cumming obtained some live specimens which took kindly to captivity and lived with the chickens belonging to the Mission boatmen; and Swinhoe also mentions a tame bird which lived in the transport square at Kandahar all the winter. Meinertzhagen says that a few birds are shot in the winter round Kabul by sportsmen out after snipe.

Fulica atra atra Linnaeus.

Specimens collected.—♂ 22 Feb. 1879 Kandahar (St. John); ♂ 4 ♀ 17-26 Feb. 1881 Kandahar (Swinhoe); sex? 29 March 1885 Kalla-i-Maur, Badghis (Merk); sex? March Andkhui (Scully); ♂ ♀ 9 Dec. 1918 Lab-i-Baring 1,600 ft. (Annandale).

The Coot is very abundant in enormous flocks in the reed-beds of the Naizars and the Hamuns of Seistan, according to both Cumming and Annandale. It is resident and Cumming took three clutches of eggs near Adimi on 14 March 1904. Large numbers are caught for food in nets stretched across channels in the reed-beds. These nets are hung on sticks stuck in the mud, the lower edge being in the water and the upper edge about 2 ft. above the surface. The flocks are driven into the nets with the aid of rafts.

Elsewhere the Coot seems to be a winter visitor or passage migrant, being particularly common in the reedy moat of the old city of Kandahar where Swinhoe says it arrived in enormous numbers in February. Meinertzhagen saw several hanging up for sale in Kabul on 13 April.

Grus leucogeranus Pallas.

Blyth (apud Hutton, p. 791) states that the Great White Crane was procured at Kabul by Sir Alexander Barnes.

Grus grus (Linnaeus).

Specimen collected.—sex? 7 Feb. 1903 Khwaji Ali (Cumming).

Anthropoides virgo (Linnaeus).

There is no doubt that most of the cranes which visit the Punjab on winter must pass over Afghanistan on passage, but there are very few actual records of the fact.

For the spring passage Whitehead remarks that 'Residents at Parachinar say that Cranes on migration fly straight over the Safed Kob Range (lowest point 11,760 ft.) and not round the western shoulder, but that they are frequently forced to turn back by storms. Major Magrath, too, has often observed them returning south-east to Bannu after a storm'.

Cumming mentions the above specimen which was shot by Col. A. H. McMahon on the banks of the Helmund on 7 Feb. 1903 and says that he himself saw a flight passing over the Mission Camp at Kuhak on 30 March 1905.

At Kabul Meinertzhagen was informed that cranes pass north in large numbers in spring during the first half of April.

For the autumn we have the authority of Yate (p. 56). At camp Khusan in October 1885 he noted that large flocks were seen daily wending their way south doubtless on the road to India.

These records appear under the names of one or other of the two species, the Common Crane and the Demoiselle, but I have combined them because in my experience the identifications of cranes in the field are usually quite unreliable (though they are not difficult to separate by those who know the distinguishing points). The single specimen collected at Khwaji Ali has in fact appeared in print in different papers under both names in turn. Both species do however migrate through Afghanistan as Meinertzhagen saw a Demoiselle hanging in a poulterer's shop in Kabul on 13 April and Barnes figured a specimen from Kabul as the 'Shuck Duruck'.

Otis tarda dybowskii Taczanowski.

Specimens collected.—♂ 29 Jan. 1885 Bala-Morghab (Aitcheson); sex? Jan. 1935 Danaghori 2,000 ft. (Maconachie).

Aitchison's specimen of the Great Bustard was shot by Lieut. Rawling out of a flock of seven. Weight 17 lbs.; weight of solid vegetable matter in the gizzard 2 lbs.; spread 7 ft. 4 in. This flock had been seen for fully a month in the vicinity and one had apparently been killed by a wild animal as feathers were picked up in large quantities. The bird was shot when the flock had been seen to alight on the top of a small hill with extremely precipitous sides, up which the sportsmen climbed. The stench of the bird was so great that the carcase was nearly abandoned by Mr. Rawlins.

Meinertzhagen ascertained that the Great Bustard is a regular winter visitor to the Danaghori Plains but it had just gone by the first week in May. Maconachie's specimen confirms this locality.

Tetrax tetrax orientalis Hartert.

Specimens collected.—sex? Koolsei near Khujah (Griffith); ♀ Nov. 1880 Kandahar (Swinhoe); sex? 12 March Maruchak, Murghab, sex? Dec. Chaman-i-Bed, Badghis (Yate).

The Little Bustard would seem to be a winter visitor to Kandahar. The above records are supplemented by St. John who says that he saw several specimens shot by sportsmen at Kandahar and once put up one himself when riding across country 12 miles south of that city in April.

Chlamydotis undulata macqueeni (Gray).

Specimens collected.—♀ 12 Feb. 1881 Abdul Rahman (Swinhoe); sex? Shorawak (Maynard); ♀ 25 March 1934 Logur 5,700 ft. (Maconachie).

The Houbara Bustard is fairly plentiful in Seistan during the spring according to Cumming, being found on the *dasht* salt-covered plains and sand-hills near cultivation. Four birds were trapped by Seistanis near Ziarat-i-Bibi Dost between Zahidan and Nasratabad and brought into camp at Kuhak on 18 March 1905. Several were subsequently seen about Sabzkim, Zaridan and elsewhere. The Biluch Nomads said that the birds bred locally but Cumming was unable to establish this point.. Eastwards round Kandahar St. John said it was common on the edge of the desert but did not breed there. Swinhoe mentions a specimen shot at Maiwand by Capt. Cuthill in February. Maconachie's bird was presumably on passage.

Burhinus oedicnemus (Linnaeus).

Specimen collected.—sex? 11 March 1885 Gulran (Aitchison).

Whitehead states (on the authority of Mr. Donald) that the Stone-Plover occurs commonly on the boundary of Afghanistan in the desert country between Jamrud and the Khyber Pass. The above specimen supplies my only record actually within the country. It is in the British Museum (wing 237 mm., tail 117 mm.) and is labelled as *astutus* but it appears to me in colour to be very close to the typical race.

Esacus recurvirostris (Cuvier).

Cumming states that c/2 slightly incubated eggs of the Great Stone-Plover were found by some camel men at Kuhak not far from the Rud-i-Seistan and brought to him on 5 June 1904. As this would be an extension of range for this species and the measurements given (2.06 × 1.5 in.) would pass for extremes of either this species or the last, the inclusion of the Great Stone-Plover in the Afghan list needs confirmation.

Cursorius cursor cursor (Latham).

Specimens collected.—♀ 19 March Gulran, ♂ 8 June 1885 Karez, Khorasan (Aitchison); ♂ 13 March 1896 Lajjikarez 2,400 ft. (Maynard); sex? March 1903 Nadali, Helmund, 2 sex? April 1903 Khwaja Ahmed (Cumming).

Aitcheson says that the Cream-coloured Courser was very common but very wary on the great gravel plains of the north-west and Cumming says that it is found all along the Helmund and its numerous branches. He adds that he had seen them in April so doubtless they breed there.

Glareola pratincola pratincola (Linnaeus).

Specimen collected.—♀ 23 April 1879 Kandahar (St. John).

This specimen, now in the British Museum, provides the only record of the Common Pratincole in Afghanistan.

Glareola lactea Temminck.

Two specimens from Jelalabad taken in March 1840 are listed in the Worcester MS. list in the British Museum.

Larus ichthyaëtus Pallas.

Specimens collected.—sex? 14 April 1874 Panjah, Wakhan (Biddulph); sex? March 1904 Seistan (Annandale).

According to Cumming the Great Black-headed Gull is fairly common in Seistan. A live bird was captured on 2 April 1904.

Larus ridibundus ridibundus Linnaeus.

Specimens collected.—♂ 30 Dec. 1880 Kandahar, 2 ♂ 13 Feb. Argandab River, ♂ 24 Feb., ♂ 26 Feb.; ♀ 11 March, ♀ 17 March 1881 Kandahar (Swinhoe); ♀ 12 March 1885 Gulran (Aitchison); sex? 18 March Maruchak, Morghab (Yate); sex? Jan. 1904 Seistan (Cumming); sex? 11 Dec. 1918 Lab-i-Baring (Annandale).

The Black-headed Gull is a common winter visitor to Kandahar according to St. John and Swinhoe, and the latter says that they started arriving about Christmas, remaining on the marsh in large packs. The above specimens complete our information about the species.

Larus genei Brème.

Specimens collected.—2 ♀ 26 April 1905 Kuhak (Cumming).

Cumming shot the above specimens of the Slender-billed Gull at Kuhak from a small flock which flew overhead.

Blyth (apud Hutton, p. 792) mentions a gull which is figured in Burnes' drawings (of which the originals are in the Indian Museum, Calcutta) as 'shot at Cabul in the middle of February: a bird of passage'. He gives a very good description which in my opinion clearly refers to this species.

Larus sp.?

Large gulls of the *argentatus-fuccus* group occur in Afghanistan and there are the following records which I am not able to identify more exactly:—

(*a*) *Larus fuscus*. The adult and young are figured by Burnes from Kabul (Hutton, p. 792).

(*b*) A bird in juvenile plumage in the British Museum labelled 1 Nov. 1879 Kandahar (St. John) was called *Larus affinis* by Howard Saunders.

(*c*) A specimen, unsexed, from Landi Barech, Feb. 1903, was called *Larus argentatus cachinnans* by Annandale.

Chlidonias hybrida indica (Stephens).

Specimens collected, sex? 29 May 1840 (Griffith); 2 ♂ 31 May 1937 Kabul 5,800 ft. (Meinertzhagen).

Meinertzhagen found hundreds of whiskered-terns on a shallow area of flooded land near Kabul on 31 May.

Hydroprogne caspia caspia (Pallas).

Specimen collected.—♀ 26 April 1905 Kuhak (Cumming).

The above specimen was one of a pair. Cumming says that the Caspian Tern was common in Seistan but he does not mention its status.

Gelochelidon nilotica nilotica (Gmelin).

Specimens collected.—sex? Jelalabad (Griffith); sex? R. Oxus, sex? 12 June 1886 Kham-i-ab, R. Oxus (Yate).

Cumming says that the Gull-billed Tern was common in Seistan and that some pairs were flying about on 22 April. Status uncertain. This and the Little Tern are evidently the species of Tern referred to by Yate (p. 245) as hovering over the pools of water caused by the overflow from the canals.

[**Sterna melanogaster** Temminck.

Cumming says that only a few Black-bellied Terns were seen in Seistan and that it was less common than in India. As no specimens were collected I feel inclined to suggest that the birds seen were in reality Whiskered-term.]

Sterna hirundo hirundo Linnaeus.

Specimens collected.—♀ 28 April 1905 Seistan (Cumming); ♀ 10 May 1937 Danaghori (Meinertzhagen).

Cumming says that the Common Tern was common in Seistan. Meinertzhagen found a few feeding on the open waters on the Danaghori Plains in the second week in May.

Sterna albifrons Vroeg.

Specimens collected.—sex? 12 June 1886 Kham-i-ab, R. Oxus (Yate); ♀ 5 May Khwaja Ahmed, ♂ 6 May, ♂ 7 May 1905 Nasratabad (Cumming).

The above specimens supply the only records of the Little Tern except that Cumming, who says that it is common in Seistan, found pairs flying about on 5 May 1905.

[**Leucopolius alexandrinus alexandrinus** (Linnaeus).

Specimens collected.—♂ 9 February, ♂ 27 February 1881 Kandahar (Swinhoe). Swinhoe and St. John say that the Kentish-plover is common in winter in the Kandahar area.

Haematopus ostralegus Linnaeus.

Blyth (apud Hutton p. 789) says of the Oyster-catcher 'Tertah-wuck of Cabul. Also procured by Sir A. Burnes' but I can find no further information about it.]

Charadrius dubius curonicus Gmelin.

Specimens collected.—2 sex? Kandahar (Griffith); ♂ 23 April 1879 Kandahar (St. John); ♀ 27 Feb. 1881 Kandahar (Swinhoe); ♀ 20 April 1885 Tirphul, Hari-Rud (Aitchison); 2 sex? 10 April Karawal Khana, Murghab (Yate); ♂ ♀ 11 March 1896 Lijjikarez 2,400 ft. (Maynard); ♂ 1 April 1904, ♀ 9 May 1905 Kuhak (Cumming); ♀ 16 April 1933, ♀ 2 May 1934 Kabul 5,700 ft., ♂ 21 June 1934 Logar 5,700 ft. (Maconachie); 3 ♂ 2 ♀ 6-7 April 1937 Kabul (Meinertzhagen).

The Little Riged-plover is rather plentiful along the banks of rivers and streams in Seistan according to Cumming and as he saw some there in summer he considered that it most probably bred in the country.

In the Kandahar area it is common in winter according to both St. John and Swinhoe, the former adding that it stays until April.

In Northern Afghanistan, Meinertzhagen considered it to be only a bird of passage. He found it not uncommon in large wisps round water near Kabul in early April and many were seen in a poulterer's shop. A pair on passage on top of the Shibar Pass at 9,000 ft. on 18 April. At Bamian on 19 April a flock of eight arrived in the morning and remained throughout that day. Burnes procured it at Kabul.

It will be noticed however that Maconachie obtained a male at Kabul on 21 June and it seems difficult to believe that the bird does not breed more widely in Afghanistan than these records suggest.

I have combined all these records under the race *curonicus* as some of the specimens undoubtedly belong to it and it is the most likely form to occur. Annandale however records Cumming's birds from Kuhak as *jerdoni* and Maconachie's Logar bird (wing 109.5 mm) would certainly pass as that form.

Cirrepidesmus mongolus atrifrons Wagler.

Specimen collected.—♀ 13 March 1896 Lijjikarez 2,400 ft. (Maynard).

This affords the only record of the Lesser Sand-Plover which must be a passage migrant.

Cirrepidesmus leschenaultii Lesson.

Specimen collected.—♂ 1896 Shorawak (Maynard).

The Large Sand-Plover must also be a passage migrant but this is the only record.

Pluvialis dominica fulva (Gmelin).

Specimen collected.—sex? Afghanistan (Griffith).

St. John says that he shot a Golden Plover near Khalat-Ghilzai in October 1879 which he was unable to preserve but which he took to belong to the eastern form as the axillaries were not white.

Golden Plovers of sorts were seen by the officers of the Seistan Mission.

Vanellus vanellus (Linnaeus).

Specimens collected.—♂ ♀ 24 Nov., ♂ ♀ 26 Dec. 1880, ♂ 11 Feb. 1881 Kandahar (Swinhoe); ♂ 16 Nov. 1884 between Zind-i-jan and Roznak, ♀ 16 Jan. 1885 Bola-Morghab (Aitchison); sex? 11 Feb. Chahor Sramba, Maimanah (Scully); ♀ 29 Oct. 1933 ♂ 28 Feb. 1934 Bagrami 5,700 ft. (Maconachie).

The Lapwing is evidently only a winter visitor to Afghanistan. It is common in the Kandahar area according to St. John and Swinhoe and Cumming says it occurs in Seistan. Hutton lists it for Kabul. The only other details are afforded by the above records.

Chettusia gregaria (Pallas).

Specimen collected.—sex? Afghanistan (Griffith); ♀ 20 Oct. 1934 Kalayal (Maconachie).

The only records of the Sociable Lapwing.

Chettusia leucura (Lichtenstein).

Specimens collected.—3 sex? Otipore (Griffith); ♂ 19 Dec. 1880, ♀ 15 March, ♂ 28 March, ♀ 31 March 1881 Kandahar (Swinhoe); 2 sex? 12 June Kham-i-ab, R. Oxus (Yate), ♀ Robat (Maynard); ♀ March 1903 Nadali, Helmund, ♀ 23 March 1903 Shahgul on Rud-i-Pariun (Annandale); ♂ 6 May 1905 Nasratabad (Cumming).

According to St. John and Swinhoe the White-tailed Lapwing is very common all the winter about Kandahar, but Cumming's specimen was the only one met in the Seistan area. Burnes procured it at Kabul. The only other information is supplied by the above records.

Lobivanellus indicus aigneri Laubmann.

Specimens collected.—♀ 21 Feb., ♂ ♀ 25 Feb., ♂ 15 March 1881 Kandahar (Swinhoe); ♂ 14 March 1896 Duganan 3,500 ft. (Maynard).

According to St. John and Swinhoe the Red-wattled Lapwing is common everywhere in the Kandahar area.

Himantopus himantopus himantopus (Linnaeus).

Specimens collected.—♂ 27 March, ♂ 5 April 1881 Kandahar (Swinhoe); sex? R. Oxus, sex? 12 June Kham-i-ab (Yate); ♀ 11 March 1896 Lijjikarez 2,400 ft. (Maynard); ♂ 3 March, ♀ 3 Sept. 1904 Kuhak, ♀ 24 April 1905 Khwaja Ahmed (Cumming).

According to his Journal Griffith met with the Black-winged Stilt at Koonur (Kunar) on 31 March 1840 and at Chughar Serai-i-Pushat on 28 Nov. 1840.

Yate's specimen from Kham-i-ab on 12 June suggests that there may be breeding places in Northern Afghanistan and Cumming says that two birds were shot at Nasratabad by Mr. McManus on 13 May 1905.

In the main however the Stilt is evidently a passage migrant both in spring and autumn. Meinertzhagen saw several in a poulterer's shop at Kabul on 13 April. St. John says they were common in early winter and spring at Kandahar, his specimens being shot on 22 February and 9 April. Swinhoe says they arrived at Kandahar in some numbers in the middle of March. Cumming's specimens from Kuhak (3 March and 3 September) and Khwaja Ahmad (24 April) agree with this status while the two Nasratabad birds (13 May) may have been only late migrants.

Recurvirostra avosetta Linnaeus.

Griffith mentions the Avocet in his Journal as seen at Pushut-Chughar Serai on 28 Nov. Otherwise it is only recorded by Meinertzhagen who saw some in a poulterer's shop at Kabul on 13 April.

Numenius arquata (Linnaeus).

Specimen collected.—sex? Afghanistan (Griffith).

Blyth lists the Curlew from Kabul (apud Hutton p. 790.). Cumming says it is very common along the shores of the Hamuns of Seistan in winter.

Limosa limosa (Linnaes).

Specimens collected.—♀ 2 March 1881 Kandahar (Swinhoe); ♂ 6 May 1905 Nasratabad (Cumming); 2 ♂ 12 December 1918 Lab-i-Baring (Annandale).

Cumming's specimen of the Black-tailed Godwit, which was said to be largely in breeding plumage, was secured on 6 May by Mr. E. A. McManus from a flock of about 20 birds.

Annandale found this species feeding in large flocks at the edge of the Hamun in December. He watched them continuously grubbing in the mud where he himself could find no living thing. An examination of their stomach contents, however, shewed that they were feeding on the seeds of water plants which were doubtless lying dormant ready to sprout when the flood season began.

At Kandahar Swinhoe shot the above specimen out of a number which appeared to be on passage. There is evidently some mistake about Hutton's statement that this godwit is common all the year.

Tringa ochropus Linnaeus.

Specimens collected.—sex? Pushut (Griffith); ♂ 30 Dec. 1880, ♀ 6 January, ♂ 1 February, ♂ 9 February 1881 Kandahar (Swinhoe); ♀ 9 Dec. 1884 between Ab-i-Kamarra and Ab-i-Shora, ♀ 1 April 1885 Gulran (Aitchison); sex? 14 April Karawal Khana, Murghab (Yate); ♀ Shorawak (Maynard); sex? 3 Sept. 1933 Sar-i-chashma 9,000′ (Machonachie); 2 ♀ 13 April Ghorband 6,700 ft., 2 ♂ 18 April 1937 Ghorband 8,200 ft. (Meinertzhagen).

Apart from the above records Swinhoe and St. John found the Green Sandpiper common everywhere in the Kandahar area in winter. In the North Meinhertzhagen met with it on passage. He says :—Common in the Ghorband Valley in flocks of from eight to fifteen birds in mid-April and were on passage being atrociously fat. At Bamian they were also in flocks, up to twenty birds, on 23 and 24 April. There were several single birds at Danaghori in the marshes on 7 and 8 May.

Tringa stagnatilis (Bechstein).

The Marsh Sandpiper was noted only at Danaghori on 9 May, when a pair was seen, and at Haibak, when three were seen on flooded fields. (Meinertzhagen).

Tringa hypoleucos Linnaeus.

Specimens collected.—sex? 18 May Darband-i-Kel Rekhta, Murghab, sex? 22 May Maruchak (Yate); ♀ 27 August 1933 Logar 5,700, ft. (Maconachie); 3 ♀ 14-18 April, ♀ 24 May 1937 Ghorband (Meinertzhagen).

Both St. John and Swinhoe say that the Common Sandpiper is common in summer in the Kandahar area but no doubt they are referring to non-breeding birds as this species is not likely to be breeding in Southern Afghanistan. It might, however, breed in the Hariab Valley 7,000-8,000 ft. as Wardlaw-Ramsay found a few pairs about the river there in May.

It certainly breeds in Northern Afghanistan. Meinertzhagen found that it had already arrived on the mountain streams by the first week in April and a pair was observed *in copula* in the Ghorbund Valley on 15 April. Observed also in breeding pairs on the river at Doab and Doshi in late April and early May. On the return journey they were noticed breeding in the Ghorbund and Paghman Valleys during the last week of May. Yate's specimens suggest that they breed in the north-west.

Meinertzhagen also observed passage movement for birds were found at Bamian in flocks of twenty individuals on 24 April in association with the Green Sandpiper and all had gone by the following morning.

Tringa glareola Linnaeus.

Specimens collected.—♀ 1 May 1881 Gungazai (Swinhoe); ♀ 5 May Khawja Ahmed ♀ 7 May 1905 Nasratabad (Cumming); ♀ 6 August 1933 Bagrami 5,700 ft.; sex? 8 Sept. 1933 Maidan-i-Pai 9,100 ft., ♂ 6 May 1934 Chahar Asia 5,700 ft. (Maconachie).

The Wood Sandpiper was numerous in May in Seistan according to Cumming and the above specimens show that it passes through on both migrations. It is common according to St. John. Meinertzhagen saw three at Danaghori on 8 May in the marshes.

Tringa totanus (Linnaeus).

Specimens collected.—♀ 9 January, ♀ 11 January, ♂ 24 January, ♂ 9 February, ♂ 30 March 1881 Kandahar (Swinhoe); sex? January, sex? n.d., sex? 7 January 1904 Seistan (Cumming); ♀ 20 May 1937 Khanabad 1,600 ft. (Meinertzhagen).

Swinhoe says that the Redshank is common throughout the winter on the banks of the Argendab River and St. John says that it stays till the middle of April. It also occurs in Seistan.

Meinertzhagen's specimen showed slight ovary development but he does not throw light on whether it appeared to be on its breeding ground.

Owing to the war I have not been able to examine the above specimens but Meinertzhagen calls his bird *terrignotae*.

Glottis nebularia (Gunnerus).

Specimens collected.—♂ 6 January, 2 ♀ 8 February 1881 Kandahar (Swinhoe); sex? 6 Sept. 1933 Farakhulm 9,300 ft. (Maconachie).

Both St. John and Swinhoe say that the Greenshank is fairly common in winter in the Kandahar area and Swinhoe says that it appeared to leave early in March.

Philomachus pugnax (Linnaeus).

Specimens collected.—sex? Afghanistan (Griffith); 2 ♂ 4 March, ♂ 9 March, ♀ 11 March, ♀ 15 March, ♀ 22 March 1881 Kandahar (Swinhoe); sex? 14-23 April 1874 Panjah, Walthon (Biddulph); ♂ 19 February ♀ 4 April Chahar Shamba (Yate); sex? 1 March 1903 Shaharistan, Seistan (Annandale).

The Ruff and Reeve are common spring passage migrants in Afghanistan, passing through all parts of the country, mostly about the beginning of March. Earliest date 19 February. Meinertzhagen saw a few Reeves, but no Ruffs, in the marshes at Danaghori in 6 and 8 May.

Erolia minuta minuta (Leisler).

Specimen collected.—♀ 5 April 1881 Kandahar (Swinhoe).

Both Swinhoe and St. John call the Little Stint a summer visitor to Kandahar but this is of course a mistake for spring passage migrant. Swinhoe says he saw several at Kandahar just before he left and he again saw it at Gungazi, Syed Yarroo and Kushdil Khan (in Baluchistan) in the beginning of May.

Hutton obtained it at Kandahar and Burnes at Kabul.

Erolia temminckii (Leisler).

According to Blyth Temminck's Stint was obtained by Burnes at Kabul. Meinertzhagen saw a few singly and in pairs on the Danaghori marshes in the first week of May.

Erolia alpina alpina (Linnaeus).

Specimens collected.—♀ 7 December, ♂ 8 December, 2 ♂ 13 Dec. 1918. This affords the only record of the Lesser Sand-Plover which must be a Lab-i-Baring (Annandale).

Annandale remarks that these 4 specimens of the Dunlin have wings 108-115 mm., so they must belong to the typical form. No other record.

Scolopax rusticola Linnaeus.

Specimens collected.—sex? 3 February Chahar Shamba, Maimanah (Yate); ♀ 26 Dec. 1931 Chailtan 5,900 ft. (Machonachie).

The Woodcock is a winter visitor to Kandahar—as Hutton, St. John and Swinhoe all record—first arriving about October or early in November and increasing with the cold weather about Christmas time and leaving about February or March. A favourite locality is the Arghundab River above Kandahar where extensive orchards and vineyards provide satisfactory cover. Swinhoe says the largest bag he had heard of was five in one day and Swinhoe mentions 20 killed in two days by two guns. Cumming says that one or two only were noted in Seistan. The only other records are provided by the above specimens.

Capella solitaria (Hodgson).

Specimens collected.—sex? Jugdulluck (Griffith); sex? 8 October Deh Tang, Ghorband (Yate); ♀ 26 Dec. 1931 Chohiltan 5,900 ft. (Maconachie); ♂ 9 April 1937 Paghman 8,000 ft. (Meinertzhagen).

There is no other information about the Solitary Snipe except Meinertzhagen's statement that his bird was one of a pair, doubtless in their winter quarters, on the rocky stream of the Paghman Valley amid snow and ice.

Capella gallinago gallinago (Linnaeus).

Specimens collected.—sex? Pushut (Griffith); ♂ 19 October 1884 between Hadj-Ali and Lundi, ♀ 17 January Bala-Morghab ♂ 19 March 1885 Gulran (Aitchison); sex? 5 February Chahar Shamba, Maimanah (Yate); ♂ 13 March 1896 Lijjikarez (Maynard); ♀ 10 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The Common or Fantail Snipe is evidently a winter visitor and passage migrant to the whole of Afghanistan from early in September until well into April. In Seistan, snipe settle in large wisps in the dense reed-beds of the Naizars according to Cumming. At Kandahar they swarmed in the large marsh outside the south gate, according to St. John, though better bags were to be made along the watercourses and in the inundated fields. The only idea of the numbers obtainable by sportsmen is given by Cumming who says that 18½ couple on 6 January 1905 was the largest bag for the Mission sportsman. Meinertzhagen says that fairly large bags are made round Kabul in March and April during passage. He noticed a few passing through Bamian on 26 April. On 7 May at Danaghori several wisps of a dozen birds or so were seen passing north at 6-30 p.m. and about a hundred feet up, calling loudly as they went and other birds from the marshes were seen to respond with a loud call and rise up to and join the migrating party.

At Danaghori there were one or two single birds in the marshes which may or may not have been going to breed. The female obtained showed slight ovary development.

Capella stenura (Bonaparte).

Cumming says that the Pintail Snipe is common in winter with the Fantail in Seistan, settling in big flocks in the dense reeds of the Naizars. There must be some mistake about this record, possibly confusion with the Great Snipe *Capella media*].

Lymnocryptes minima (Brünnich).

Specimens collected.—2 sex? Pushut (Griffith); ♂ 19 Oct. 1884 between Hadj-Ali and Lundi, ♂ 5 March 1885 Glran (Aitchison).

In North-west Afghanistan the Jack Snipe was seen occasionally all over the country according to Aitcheson and it will be noticed that his specimens give arrival and departure dates of 19 Oct. and 5 March. Cumming says this species is moderately numerous in Seistan. At Kandahar St. John says that it arrives later and leaves earlier than the Fantail and Swinhoe says it came in with the very cold weather about Christmas, was fairly plentiful all through January and then disappeared again.

Meinertzhagen says there were many in the Kabul marshes on spring passage in the first week of April, as many as fifteen being shot in a day. In fact they then seemed to be more abundant than Fantails.

Griffith mentions in his Journal that the Jack Snipe was common at Bala Chughur Serai on 3 March 1840 and he notes it again at Pushut on 31 March 1840.

Rostratula benghalensis benghalensis (Linnaeus).

Specimen collected.—sex? 17 April 1840 Jellalabad (Griffith).

Hutton says that the Painted Snipe occurs at Kandahar.

Pelecanus onocrotalus Linnaeus.

Hutton describes a specimen of the White Pelican which he says was shot in a pool of water at Kandahar. It was alone and from its emaciated condition appeared to have alighted from fatigue. Several were brought into Kandahar, he continues, which had been found sitting on the rocks far from any water and had offered no resistance to capture. All these birds he considered stragglers from the large flocks that arrived on passage at the beginning of March, travelling eastwards.

Cumming also mentions a live specimen brought to Col. A. H. McMahon at Natali on 6 March 1903. This may have been the same bird as the unlabelled specimen which Annandale lists as a very typical example of this species.

As Yate (Northern Afghanistan, p. 56) remarks under Camp Kuhsan, Oct. 1885, that now and then a flock of Pelicans were seen travelling south, this bird would seem to pass over Afghanistan on both passages.

Cumming saw two large Pelicans (species unidentified) on the Hamun-i-Sabari on 12 January 1905.

Phalacrocorax carbo sinensis (Shaw & Nodder).

Specimens collected.—♀ 14 March, ♀ 16 March 1881 Arghandab River (Swinhoe); sex? 19 March Maruchak, Badghis (Yate); sex? Feb. 1904 Seistan (Annandale).

Griffith describes in his Journal two cormorants 'distinct from any I have seen hitherto, very black with some white marks. The common black one also seen.' This was at Bala Chughur Serai on 16 March 1840.

St. John says the cormorant is occasionally seen on the Arghandab River but is not common. Swinhoe's two specimens were the only ones he saw.

In Seistan, cormorants are common. Annandale says they are captured and shot in large numbers by the Saiyids. The down from the breasts is sometimes mixed with the soft wool out of which the felt hats worn by Persians are made.

Scully says that the Maruchak specimen is in full breeding plumage.

Phalacrocorax niger (Vieillot).

Specimens collected.—sex? 28 Dec. 1884, ♀ 12 Jan., ♀ Jan. 1885 Bala Morghab (Aitchison).

The only records of the Little Cormorant.

Phalacrocorax pygmaeus (Pallas).

Specimen collected.—♀ 7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

Meinertzhagen says that the Pygmy Cormorant was not uncommon at Danaghori but he found no evidence of nesting though the large reed-beds were ideal for it.

Platalea leucorodia Linnaeus.

Specimens collected.—2 sex? 25 March 1885 Kalla-i-Maur, Badghis (Aitchison); ♂ 4 June 1931 Bagram 4,900 ft. (Maconachie).

The Spoonbill was procured at Kabul by Sir A. Burnes. St. John says that he saw one at Khalat-i-Ghilzai and heard of others being shot. The specimens complete the records, but Maconachie's bird was received from captivity.

It should however be recalled that Magrath and Whitehead were standing on the Peiwar Kotal (8,200 ft.) on 30 April 1906 when a flock of about 20 Spoonbills came up from the Kurram and passed overhead—'but apparently not relishing the strong north-west wind which met them as they topped the Kotal (i.e. pass) they wheeled round and flew back down the valley' (Ibis, 1909, p. 278).

Plegadis falcinellus (Linnaeus).

Specimens collected.—sex? Pushut, sex? Afghanistan (Griffith); sex? 14-23 April 1874 Panjah, Wakhan (Biddulph).

From Griffith's Journal it is probable that his Pushut specimen was obtained on 31 March 1840. Sir A. Burnes met with the Glossy Ibis at Kabul and St. John says that a solitary bird is found here and there about the Kandahar area. Meinertzhagen saw a flock of twelve birds at Danaghori feeding in the marsh on 6 and 7 May. A second and larger flock was seen in a marsh near Kabul on 31 May.

Caiconia ciconi (Linnaeus).

St. John says that the White Stork is occasionally noted at Kandahar on spring and autumn passage but curiously enough no one else has recorded it.

Ciconia nigra (Linnaeus).

Meinertzhagen met with a single Black Stork in the stream-bed of the Bamian Valley on 27 April. It was very wild, rising at 500 yards and sitting on a rock so situated that he could see all around him. Blyth says that Burnes procured this species at Kabul.

Ardea cinerea Linnaeus.

Specimens collected.—♂ 12 Dec., ♀ 17 Dec. 1880, ♂ 2 Jan., ♂ 26 Feb. 1881 (Swinhoe); sex? Feb. 1903 Khwaja Ali, sex? Dec. 1904 Farrah Rud (Cumming); ♂ 26 March 1933 Jebel Siraj 5,400 ft. (Maconachie).

The Heron is common in winter in the Kandahar area according to St. John and Swinhoe and Cumming found it in Seistan. Whether it breeds in the country is unknown. Sir Alexander Burnes obtained it at Kabul and Meinertzhagen saw specimens there for sale on 13 April. The latter saw several every day in the marshes at Danaghori in the second week in May and a single bird at Kunduz on 21 May.

Egretta alba alba (Linnaeus).

Specimens collected.—♂ 24 Feb. 1881 Kandahar (Swinhoe); ♂ 11 June 1933 Kabul 5,700 ft. (Maconachie).

Meinertzhagen saw two specimens of the Large Egret near Kabul, namely a tired bird resting on ploughed land on 11 April and a second bird in a marsh on 31 May. The late date of Maconachie's bird should be noted. According to St. John and Swinhoe it is not uncommon about Kandahar, the latter considering it a winter visitor leaving about the end of March.

Herodias garzetta (Linnaeus).

According to Blyth the Little Egret was obtained by Sir Alexander Burnes at Kabul but there is no other record.

Nycticorax nycticorax nycticorax (Linnaeus).

Specimen collected.—♀ 1 May 1934 Jalalabad 1,800 ft. (Maconachie).

Meinertzhagen saw six Night Herons at Kunduz on 20 May flying over the marshes at dusk. In addition to Maconachie's specimen and St. John's statement that there was a small colony in a garden near Kandahar this bird is only recorded by Hutton as found in the winter on the banks of the larger rivers.

Ixobrychus minuta minuta (Linnaeus).

Specimens collected.—sex? 28 April, sex? 1 May, sex? 15 June 1879 Kandahar (St. John); sex? April 1903 Khwaja Ali (Cumming); ♂ 27 May 1934 Bagrami 5,700 ft. (Maconachie).

These records are only supplemented by St. John's remark that the Little Bittern is not uncommon at Kandahar in summer.

Botaurus stellaris stellaris (Linnaeus).

Specimens collected.—♀ 18 March 1881 Kandahar (Swinhoe); 2 ♂ 1 ♀ 29 Dec. 1884 Bala Morghab, ♂ 15 Feb. 1885 Karawal Khana, Bedghis (Aitchison); sex? Dec. 1904 Farrah Rud (Cumming); ♂ 15 March 1933 Bagrami 5,700 ft. (Maconachie); ♂ 10 April 1937 Kabul (Meinertzhagen).

The Bittern appears to be very generally distributed in Afghanistan. At Kunduz on 20 May Meinertzhagen heard continuous booming in the marshes towards sunset and one is probably justified in believing that the birds were on their breeding ground. In the Morghab in winter Aitchison found it very common, living in exactly the same places as the pheasants. At Kabul according to Meinertzhagen it is a regular bird of passage and many are shot in the marshes there in spring. In the south Cumming's specimen shows that it is found in Seistan and Hutton says that it is found along the banks of the larger rivers such as the Arghandab and the Helmund. At Kandahar it seems to be a winter visitor but Swinhoe only met with it between the middle of February and the middle of March.

[**Phoenicopterus ruber roseus** Pallas.

Cumming states that he saw a flock of Flamingoes flying over the Mission Camp at Kuhak on 28 April 1905, travelling north in the direction of the Hamuns and odds that other flights were seen from time to time. The identification of the flocks with this species seems conjectural though no doubt both species of Flamingo occur in the country.]

Phoeniconaias minor Geoffroy.

Specimen collected.—sex? June 1904 Kuhak (Cumming).

This specimen was identified by Mr. Stuart Baker who says that it is a young bird but exceptionally large with a wing of 13.6 in. (345 mm.). There seems, however, to be some confusion over the data as Cumming himself says that the only specimen secured by the Mission was shot by K. B. Mir Shams Shah on the Farrah Rud in Dec. 1904.

Cygnus cygnus (Linnaeus).

Specimen collected.—[♂] Dec. 1904 Hamum-i-Sabari (Cumming).

Cumming says that 'a fine specimen of the Whooper Swan was brought into the Mission Camp on the Farrah Rud on 13 January 1905. It was shot by a Sayid (Fowler) on the Hamun-i-Sabari where it appears to be fairly numerous. Many of the young are said to have been caught on the Hamuns so that this Swan may be considered a resident.

This is evidently the same specimen mentioned by Stuart Baker (p. 132) and by Colonel Sir Henry McMahon (Ibis, 1906, p. 398) who says that it was obtained on 14 January 1905. I presume the contradiction in dates would have been due to the Sayid bringing in the bird as a skin and not in the flesh. Sir Henry goes on to state that the Mission observed a great many swans, all as far as he could see of the same species, and that he also saw several young birds which had been bred on the Hamun. This information was elicited by a note in the Ibis by Buturlin (Ibis, 1906, p. 737) suggesting on the authority of Sarudny that it was the Mute Swan (*Cygnus olor*) that bred in Seistan and that the Whooper was only a rare winter visitor to the country. Dr. Annandale (Ibis, 1906, p. 612) and Mr. A. Thomson (Ibis, 1907, p. 511) then wrote to confirm the identification of the specimen as a Whooper Swan.

Cumming was of opinion that the Mute Swan also occurred on the Hamuns of Seistan though no specimen had been procured.

Anser anser (Linnaeus).

According to Cumming the Grey-Lag is common in Seistan. He preserved no specimens but says he obtained one near the Hamun-i-Sabari on 27 Dec. 1904 and was sent another from Kila-i-Nao during March 1905.

According to Hutton this species is a winter visitor to Kandahar. As Swinhoe, St. John and Murray all mention geese of sorts as being fairly common about Kandahar and the River Argandab, the probability is that they are, mostly referring to this species.

[**Anser albifrons** (Scopoli).

Murray says that a Mr. Hutchins obtained the White-fronted Goose on the Argandab River. Swinhoe says that he noted two (and he believed three) kinds of geese on that river in the winter.]

Tadorna tadorna (Linnaeus).

Specimens collected.—sex? Feb. Oxus River (Yate); pull. August, pull. n.d. Seistan, ♂ juv. Sept. Kuhak, 2 ♂ juv. 3 Oct. 1904 Seistan (Cumming); ♂ ad. 14 Dec. 1918 Lab-i-Baring (Annandale); ♀ 12 Nov. 1934 Kabul 5,700 ft. (Maconachie).

Cumming has the following note on the Sheldrake in Seistan :—'This is a permanent resident in Seistan and rather numerous during the winter. On 22 April 1904 the Irrigation Camp came across a large number of very young ducklings of this species between Chah Mahomed Raza and Sekkoha, in small bushes at the foot of the high "dasht" on a dry portion of the Hamun. Near by were some low reeds, while the water of the Hamun itself was some three hundred yards off. There were several full grown sheldrakes, each followed by a brood of some 15 or 16 ducklings. Eleven of these ducklings were captured and sent to me and a few of them lived till they were full grown. On 24 June 1904 one of these flew away and I was compelled to clip the wings of the remainder.'

Hutton says the Sheldrake is a winter visitor to Kandahar as it may also be at Kabul and on the Oxus.

Casarca ferruginea (Pallas).

Specimens collected.—♀ 25 Feb., ♂ 1 March 1881 Kandahar (Swinhoe); sex? 10 April Karawol Khana, Murghab (Yate); ♂ 6 March 1886 Gulran (Aitchison).

According to Dr. Aitchison the Ruddy Sheldrake was occasionally seen and was breeding in the cliffs overhanging the Hari-Rud River.

Hutton, St. John and Swinhoe all agree that it is a winter visitor to Kandahar.

Anas platyrhyncha platyrhyncha Linnaeus.

Specimen collected.—♀ Shorawak (Maynard).

Meinertzhagen considers it probable that the Mallard breeds at Danaghori where a few were seen in pairs in suitable country on 6 May.

St. John says that he had seen 'a related couple or two' on the Argandab River as late as the first week in June.

With the exception of these two statements the Mallard is only known as a winter visitor or passage migrant to Afghanistan. At Kandahar Hutton, St. John and Swinhoe all found it common. St. John says it arrives about the end of October or early in November. Swinhoe found it common in January and February, starting to leave again at the beginning of March and all being gone by the middle of the month.

In Seistan Cumming says it is numerous on the Hamuns, arriving late in autumn and leaving in March.

Meinertzhagen found this to be the most abundant species of duck about Kabul both in the winter months and on spring passage.

Eunetta falcata (Georgi).

Specimen collected.—[♂] 28 Dec. 1884 Bala Morghab (Aitchison).

This specimen, shot by Capt. Heath, provides the only record of the Bronze-capped Teal for Afghanistan.

Chaulelasmus streperus (Linnaeus).

Specimens collected.—♂ 14 Feb., ♂ 18 Feb., ♀ 20 Feb., ♂ 20 March 1881 Kandahar (Swinhoe); ♂ ♀ 22 Jan., ♂ 9 Feb. 1885 Bala Morghab (Aitchison); sex? 16 April Karawal Khana, Murghab (Yate).

The Gadwall is a winter visitor and passage migrant to Afghanistan and in addition to the above records from the north Burnes records it from Kabul and Meinertzhagen saw it hanging up for sale there on 13 April. In the

Kandahar area St. John says it was common throughout the winter and Swinhoe found it in great numbers throughout the months of January, February and March, leaving about the end of the last mentioned month.

In Seistan also Cumming says it leaves in March but there he did not find it common.

Mareca penelope (Linnaeus).

Specimens collected.—♀ Otipore (Griffith); ♂ 14 Jan., ♂♀ 20 Feb. 1881 Kandahar (Swinhoe); ♀ 14 Jan. 1884, ♂ 20 Jan. 1885 Bala-Morghab (Aitchison); ♂ 15 March Maruchak, Morghab (Yate); ♀ Shorawak (Maynard).

Swinhoe says that a few Wigeon are occasionally shot at Kandahar in January and February but that the species was scarce and he did not see it before or after those months. St. John also found it uncommon but Hutton calls it a winter visitor, disappearing gradually to the end of April.

In addition to the records for the north provided by the above specimens I may add that Meinertzhagen saw this species exposed for sale in Kabul on 13 April.

Nettion crecca crecca (Linnaeus).

Specimens collected.—♀ 14-23 April 1874 Panjah, Wakhan (Biddulph); 2 ♂ 17 Dec., ♀ 23 Dec., ♀ 25 Dec. 1880 Kandahar (Swinhoe); ♂ 23 Jan. 1885 Bala-Morghab (Aitchison); ♂ 25 Jan. Chahar Shamba, Maimanah (Yate); ♂ 1896 Sahibzada (Maynard); ♂ 3 Oct. 1904 Kuhak (Cumming); ♂ 8 Dec., ♂ 11 Dec. 1918 Lab-i-Baring (Annandale).

The Teal is said to be a very common winter visitor to the whole of Afghanistan wherever there is any suitable water, being found alike in the north, in Seistan and in the Kandahar area. It is also numerous on passage and Cumming relates how Capt. R. C. Bell saw thousands all over the country between Kuhak, Zahidan and Lutak between 1 and 10 April 1905. Every piece of water he came to was literally covered with them.

Whether the Teal breeds in the country is not quite clear. Swinhoe understood that it did so in the Kandahar area and says that he flushed 2 or 3 pairs at Syed Yaroo and Gangazai from the reeds in the watercourse at the beginning of May. Cumming says it appears to breed in Seistan and Meinertzhagen thought that it probably bred at Danaghori where he saw the birds in pairs in suitable country on 8 May.

Dafila acuta (Linnaeus).

Specimens collected.—♀ 18 Feb., ♂ 20 Feb. 1881 Kandahar (Swinhoe); ♂ 8 Dec. 1918 Lab-i-Baring (Annandale).

The Pintail appears to be one of the commoner ducks of Afghanistan as a winter visitor. Burnes and Meinertzhagen both record it from Kabul. St. John found large flocks in the inundated fields bordering the river near Kelat-i-Ghilzai in October. Hutton, St. John and Swinhoe say they are common at Kandahar in winter, Swinhoe adding that they left altogether about the middle of March.

In Seistan they are also common, arriving late in autumn and leaving in March according to Cumming.

Querquedula querquedula (Linnaeus).

Specimens collected.—♂ 14-23 April 1874 Panjah, Wakhan (Biddulph); ♂ 28 March 1881 Kandahar (Swinhoe).

The above specimens, doubtless birds on passage, furnish the only records of the Garganey for Afghanistan beyond the statement made by Blyth that Burnes obtained it at Kabul.

Spatula clypeata (Linnaeus).

Specimens collected.—sex? 14-23 April 1874 Panjah, Wakhan (Biddulph); ♂ 15 Feb., ♀ 27 Feb., ♂ 21 March 1881 Kandahar (Swinhoe); ♂ 18 March 1885 Kalla-i-Maur, Badghis (Aitchison); ♂ 1896 Shorawak (Maynard).

The Shoveller is said by Hutton, St. John and Swinhoe to be a common winter visitor to the Kandahar area which it leaves in March according to Swinhoe. Cumming found it numerous on the Hamuns of Seistan and suspected that it might breed there. Burnes and Meinertzhagen record it from Kabul. Further north our only records are furnished by the above specimens.

Marmaronetta angustirostris (Menetries).

Specimens collected.—♀ 7 March 1881 Kandahar (Swinhoe); sex? 27 Oct. 1884 between De-Kamran and De-Doda, sex? n.d. Bala-Morghab (Aitchison); sex? 12 June Kham-i-ab, R. Oxus, Afghan Turkestan (Yate); 4 juvs. 6 July 1904, ♂ 22 April 1905 Kuhak (Cumming).

The headquarters of the Marbled-Duck in Afghanistan are evidently in Seistan and it is worthwhile quoting Cumming's account:—'Within a radius of 4 miles round Kuhak, Major F. W. Irvine, I.M.S., and Capt. R. C. Bed between 7 and 23 April 1904 shot no less than 80 of this species alone. It is a permanent resident and begins to breed at the end of April. I shot a pair on 22 April 1905 near Kuhak and found on examination that the female would have laid in about a week's time, while on 5 May of the same year a female with nest and 16 eggs, all more or less fresh, was sent to me by Lala Thakur-dass, Irrigation Supervisor, from near Old Shaharistan. Ducklings were also brought to me on the following dates:—

1 June 1904	1
14 June 1904	2
6 July 1904	5, nearly full-grown.
8 July 1904	Several, nearly full-grown.

I also shot a fully-grown bird on the Rud-i-Seistan on 3 October 1904.'

At Kandahar, according to St. John, the Marbled-Duck is not very uncommon, most large bags containing one or two, but Swinhoe says that his specimen was the only one obtained. The only other records are furnished by the specimens enumerated above.

Netta rufina (Pallas).

Specimens collected.—♂ 28 March 1881 Kandahar (Swinhoe); 2 ♂ Jan. ♀ 23 Jan. 1885 (Aitchison); ♀ Dec. 1904 Farrah Rud (Annandale).

According to St. John the Red-crested Pochard was not uncommon at Kandahar but Swinhoe says that he did not meet with it except in March when he knew of 5 being shot. Cumming found it numerous on the Hamuns of Seistan in winter and thought that it might remain to breed in the Naizar. Burnes recorded it from Kabul. The only other records are provided by the above specimens.

Nyroca ferina (Linnaeus).

Specimens collected.—♂ 9 March, ♀ 11 March 1881 Kandahar (Swinhoe); 2 ♂ 10 Dec. 1918 Lab-i-Baring (Annandale).

Burnes met with the Common Pochard at Kabul and Meinertzhagen noticed it exposed for sale there on 13 April. At Kandahar both St. John and Swinhoe found it uncommon, the former saying that it was not as frequently met as the Red-crested Pochard, the latter saying that a few were shot in March only. In Seistan Cumming found it common in winter and he hazards his usual suggestion that it might breed on the Naizars.

Nyroca rufa (Linnaeus).

Specimens collected.—♂ 14 Feb., ♂ 17 Feb., ♂ 19 Feb. 1881 Kandahar (Swinhoe); ♂ ♀ 5 March Kila Wali, Murghab, ♂ 16 March Maruchak, Badghis (Yate).

Hutton, St. John and Swinhoe all agree that the White-eye is very common in the Kandahar area. Swinhoe indeed calls it the commonest duck in the country after the Gadwall and says that it arrived in the beginning of February and suggests that some appear to remain in the country to breed. He flushed many pairs out of reeds and tamarisk on the banks of the water-courses in the Pishin and right down the Bolan as far as Kirta in May (though these localities are of course actually across the Baluch border). Maynard met it on the Afghan-Baluch border.

Cumming found it common in Seistan in winter. Yate's specimens from the Morghab and Badghis complete the record.

Nyroca fuligula (Linnaeus).

Specimens collected.—♂ 19 Feb. 1881 Kandahar, 2 ♂ 1 ♀ 5 March 1881 Kokeran (Swinhoe); sex? 20 Feb. Chahar Shamba, Maimanah (Yate); ♂ Afghan-Biloch border (Maynard).

The Tufted-Duck is very common at Kandahar according to Swinhoe, arriving at the beginning of April. Cumming found it in winter in Seistan. Burnes found it common at Kabul where Meinertzhagen saw it exposed for sale on 13 April. Yate's Maimanah specimen completes the record.

Glaucionetta clangula (Linnaeus).

Specimens collected.—♂ 15 Jan. 1885 Bala-Morghab (Aitchison); ♀ 12 Feb. Chahar Shamba, Maimanah, sex? 15 March, ♂ 20 March Maruchak, Morghab (Yate); ♂ Dec. 1904 Hamun, Seistan (Annandale).

The above records suggest that the Golden-eye is a winter visitor to Afghanistan generally but in spite of Hutton's remark that it is common at Kandahar —neither Swinhoe nor St. John record it—it would seem to be uncommon. Cumming says that only two specimens were shot in Seistan by the members of his Mission. That was in January 1905 when the cold was unusually severe.

Erismatura leucocephala (Scopoli).

Specimens collected.—♂ ♀ 20 Oct. 1879 Jameh River near Khelat-i-Ghilzai; sex? 21 March Maruchak (Yate).

The Stiff-tailed Duck was first discovered in Afghanistan by St. John who procured the above pair of immature birds on 20 October 1879 on the Jameh River near Khelat-i-Ghilzai. The event is recorded in full by Hume in *Stray Feathers*, vol. viii, p. 456. Yate then obtained a specimen on 21 March at Maruchak and later Cumming found it very common on the Hamuns of Seistan during the winter when several were shot but apparently not preserved by members of the Mission.

Mergellus albellus (Linnaeus).

Specimens collected.—2 ♀ 30 Jan. 1881 Argendab River near Kokeran, ♀ 2 March 1881 Kandahar (Swinhoe); 2 ♂ 1 ♀ 29 Dec. 1884 Bala-Morghab (Aitchison); ♂ 10 Feb. Maimanah, ♂ 12 Feb., ♀ 17 Feb. Chahar Shamba, Maimanah (Yate).

The list of the above specimens is supplemented by Hutton's statement that he only saw one specimen of the Smew at Kandahar but heard that it was common in winter near Ghuzni.

Mergus serrator Linnaeus.

Specimens collected.—♀ 21 Jan. ♂ 30 Jan. 1885 Bala-Morghab (Aitchison). I can trace no other record of the Red-breasted Merganser in Afghanistan.

Podiceps cristatus (Linnaeus).

The Great Crested Grebe is only recorded by Cumming who says that it is fairly common in the Seistan Hamuns during winter. He adds that on 4 February 1904 he saw several near Puzak in the deep open patches of water.

Podiceps ruficollis capensis Salvadori.

Specimens collected.—♂ 4 March, 2 ♀ 8 March 1881 Kandahar (Swinhoe); ♀ 11 Dec. 1918 Lab-i-Baring (Annandale).

The Little Grebe is very common among the reed-beds of the Hamun in winter according to Annandale and it must breed there as a young bird was brought to Cumming at Kuhak on 7 July 1904. Hutton says it is common in the marshes and pools south of Kandahar in winter but St. John and Swinhoe both—probably more correctly—say that it is found there on passage in spring and autumn. Swinhoe says that it arrived in the beginning of March.

In conclusion it is perhaps worth stating that I can find no evidence for the inclusion of the following species or races in the avifauna of Afghanistan though that country is included in their range as given in the second edition of the *Fauna of British India, Birds*. That many of them do actually occur within Afghan boundaries is of course not improbable.

Corvus splendens zugmayeri.
Dendrocitta vagabunda.
Parus major intermedius.
Parus palustris korejewi.
Molpastes leucogenys leucogenys.
Certhia himalayana taeniura.
Oenanthe monacha.
Phoenicurus frontalis.
Rhyacornis fuliginosa.
Calliope pectoralis pectoralis.
Prunella himalayanus.
Pericrocotus roseus.
Phylloscopus tytleri.
Phylloscopus pulcher kangrae.
Seicercus xanthoschistos albosuperciliaris.
Scotocerca inquieta striata.
Cephalopyrus flammiceps.
Sturnus vulgaris humei.
Uroloncha malabarica.
Mycerobas melanoxanthus.
Hirundo rustica gutturalis.
Anthus hodgsoni hodgsoni.
Eremophila alpestris longirostris.
Cinnyris asiatica brevirostris.
Clamator jacobinus.
Gyps himalayensis.
Columba leuconota.
Pterocles lichtensteinii.
Lerwa lerwa.

SOME REMINISCENCES OF SPORT IN ASSAM.

BY

H. G. H. M.

(*Continued from page 332 of volume 45*).

PART III.

In some parts of the plains of Assam are to be found vast stretches of country covered by grass in patches, in some places high and dense, in others light and interspersed with open spaces covered by green grass. These uncultivated areas are called 'chapris' and a well known one is the 'Pakar Chapri' which is surrounded by heavy, dense jungle bordered on three sides by a stream in which there used to be very good fishing. I use the past tense, for in Assam, as in most parts of India, the people of the country have woefully diminished the freshwater fish supply of the land by all sorts of poaching and destructive malpractices: and this is true of even the larger rivers.

To get to the Pakar Chapri from Sadiya one drives to the bank of the Brahmaputra river which is then crossed by means of a 'mar'. On the other side is a wide stretch of sand—this is in the cold season when the river runs low—over which is laid a brushwood track for the easier passage of motor cars. Thus one arrives at Saikwa Ghat, the terminus of the Assam-Bengal Railway. From here one motors for miles and miles through heavy tree jungle, the haunt of all sorts of wild animals, and a rich avian life. Then one arrives at Kobo on the Brahmaputra which is reached by again crossing the river on a 'mar'. During this passage over the river there are sandbanks to be avoided and there are days when the crossing can be dangerous owing to a sudden rise in the river which at this place has not long issued from the mountains. Thinking of Kobo brings to mind the occasion when the Assistant Commandant at Pasighat was on his way down to Saikwa Ghat. He ran his car down the bank too fast and so shot over the 'mar', burst through the pole barriers on the further side of it and plunged into the river! 'More haste less speed', 'Safely First' and that kind of thing. In the car was a box containing his wife's party frocks and fripperies. The box was to be forwarded to her in Shillong, and as the car was not retrieved from the water for several hours the state of the garments can be imagined, as also the state of mind of the poor wife when she saw them.

From Kobo we drove through more forest to Pasighat. This used to be a very pleasant place as the houses of the officials were along the river bank and one had only to go a hundred yards or so to fish for mahseer. There were times when there was not at Pasighat anyone fond of fishing. What waste of opportunity! On the way down river from Pasighat to Pakar Chapri there are many rapids to be negotiated, some of them, to the mind of a non-swimmer, appearing very dangerous, but good fun to those less timorous. I was in a large dug-out which could have easily been capsized, for the river had suddenly begun to rise and it was impossible to stop the boats which were, however, most skilfully managed by the expert and courageous boatmen. On the return journey I preferred to ride an elephant.

The elephants were made to swim across the river, and so swift was the water that they were many times submerged, only their trunks being above the surface, and how the mahouts managed to stick to their charges was a mystery to me, but all crossed in safety.

Life in this camp was very delightful. We had fishing and all sorts of shooting with rifle and shot gun. Daily the *chapri* was explored on elephant-back. A number of buffalo was seen, as many as sixteen in one herd, among them two young bulls; and one female had such enormous horns that we debated whether they were not something approaching the record which is nearly fourteen feet tip to tip across the forehead! I don't suppose they were within a couple of feet of that but it was seriously discussed whether we should shoot the animal and pay the fine of fifty rupees. Better counsels prevailed so she was left in peace. She was not an old animal, though to have attained such imposing horns she must have been well on in years.

Green-pigeon and jungle-fowl were shot, some of the latter with a .22 rifle as they pecked about on the edge of the cover across the stream. Green-Pigeon were in thousands in those parts, the larger flocks containing birds of several well-known species. Large bags are made during the months succeeding the breeding season, the time when this has ended being known by the birds collecting into huge flocks which, with some species, amount to many thousands. The largest bird is the Bengal Green-Pigeon; others are the Ashy-headed and the Thick-billed both of which are very fast fliers, and the Orange-breasted Green-Pigeon. The jungle fowl is the Common Red variety and among other game birds is the Black-breasted-Kalij Pheasant not easily come by owing to its skulking habits. That shoot at Pakar Chapri in company with our son-in-law, C. of the Police, T. the Forest Officer, and N. of the Saw Mills (Bird & Co.) remains a very pleasant memory to us both. But I have forgotten the rogue elephant. There was known to be one in the jungles through which we had to pass on our way to camp: and my wife, who had not been on an elephant where tiger could be met since she experienced the charge previously related, was very much alarmed when the mahout suddenly pointed to a spot in the forest where an elephant had evidently just passed. I did not feel too happy, having with me only one of those all-in-one three-barrelled weapons—a double 12 gauge with a .405 barrel beneath. We pushed on as fast as possible and left the tree jungle for the open grass land as soon as could be managed. By doing this we saw various kinds of game animals: buffalo, sambar, hog-deer, also wild cats and pig. In the stream not far from camp quite large mahseer were caught.

On a number of occasions the Rajah of G. arranged shoots for the Governor of Assam and other high officials; then he would supplement his own elephants by animals of the Forest Department and others borrowed from zamindars. He did not very much care for these big occasions but always did his best to make them a success. From the time he arrived in camp he every evening interviewed 'khubberias'—bringers of information of the whereabouts of tigers, and decided what beats to carry out the next day. Buffaloes were never tied out as baits as is commonly the practice in other parts of India. Months before these important shoots his shikaris toured through all the likely jungle tracts and marked down all the places where cattle were being killed. A central spot was chosen for the camp—usually on the banks of a stream and in open country, so that those bringing information could have ready access to it. The men would cover all the country within ten or twelve miles round the camp. The informant was given ten rupees for each tiger shot, was fed in camp for as many days as was necessary, and taken out on a pad elephant when his particular tiger was to be hunted.

Every evening the Rajah arranged details of how the elephants should be fed, making fodder arrangements for twenty-four hours. He would also listen to all complaints, make particular enquiries as to any tusker becoming 'musth', and if in any doubt would personally inspect the animal. All elephants had to be daily examined for sore backs or other injuries, rope-galls and the like. In all this he was thorough and painstaking, as a good Commander should be, hence his known success on all occasions. A start was always made by 10 a.m. and the shooting ground reached by 1 or 2 p.m. Then, as soon as the Rajah had personally ascertained the lie of the land and the signs of the tiger being present were good, beats would be arranged, the guns placed in position, and the beat started, he himself giving orders as to the manner and direction of the drive. If tiger were few the sport was perhaps over by 3-30 p.m. when lunch would be served; but if there were several tigers then it was good-bye to lunch. On the way out and back all guests rode pad elephants, these animals having faster paces: they did not generally take part in the beats.

On return to camp tea was available, and dinner at 9-30 to 10 p.m. After that one could go to the big tent in which was singing and dancing. The first time I saw a boy dressed as a girl I was asked his sex, knowing the Rajah did not allow women in the camp I said 'Middle-sex'; and this was thought a great joke, that boy being ever after known by the name of Middlesex. The Rajah always said of these semi-official outings that they were not 'shoots' but huge picnic parties, and that it could be very dangerous both to guns and beaters. 'I like punctuality,' he said, 'and the starts are frequently delayed for one reason or another so the shooting ground is not reached in time and lunch is demanded, tables laid out, chairs placed, and so on, all meaning delay and waste of time, so that it is after 3 o'clock before a start can be made. Then the guns, having had lunch and beer are in an excited mood and do dangerous things; it is difficult to control, and frequently the tiger gets away from the beat.' One reason for tigers escaping without being shot at is that the mahouts, seeing the 'hullee' approaching and having little confidence in the howdah guns, deliberately cause their elephants to turn away and fidget, or even run away. The visiting sportsman as often as not knows nothing of 'hullee' sign, or that the elephant is being wilfully made unruly and does not connect this with the advancing tiger which quietly slips by and escapes the beat.

Mahouts have to be considered. Seated astride the necks of their majestic beasts they are in considerable danger from the attacking tiger, and it is natural they should be anxious as to the nerves and weapons of the sportsmen in the howdah, not only the guns on his own elephant but those on either side of him. They do not like single barrel weapons or small bore rifles, and one cannot convince them of the efficacy of magazine weapons. Very naturally mahouts discuss among themselves the merits and demerits of the various sportsmen, more especially on these semi-official shoots, and also gather information from camp servants as to their respective masters.

The Rajah always strongly objected to ladies shooting; he was ever afraid of something happening and there was once a terrible tragedy during one of his semi-official shoots. He never spoke of it. A mahout was killed, one of the guests shot in the ankle, and an elephant subsequently died of a bullet wound. To guests not known to him, not known that is as to nerves and straight shooting, he gave a card of 'Don'ts' and arranged for a reliable and experienced man to be at the back of the howdah. During beats he walked his own elephant backwards and forwards behind the line of howdah elephants and shot at those tigers only which were missed by the guests. I have seen him shoot a number of tigers under these circumstances.

The question whether tiger shooting from elephants is a dangerous sport is often discussed. Many there are who assert that it is not, but much can be said for the opposite view. Shooting tigers by sitting up over a kill at night is often looked down upon by those who bag tigers by beating for them. In the latter case the sportsman is almost always perched in a tree, on a ladder, or other elevation as also in the former. In both instances the sportsman is in almost no danger unless and until he wounds the tiger.

Then, it must be admitted, he more or less takes his life in his hand when he follows up—as he must do; and, it has to be added, his mostly unarmed followers, without whose help he would, in most cases, be unable to locate and bring the wounded beast to action are equally exposed to death or injury.

Tigers are hunted and shot from elephant-back in jungles where to pursue them on foot is mostly impossible owing to the denseness of the cover. To beat them out without elephants is almost hopeless, the only alternative being sitting up, or through some more or less chance encounter.

Is tiger shooting from elephants dangerous? I think I can demonstrate from a number of experiences that, though it is not always so, it can be and may be; not so much on account of the attacks of wounded, surrounded, infuriated tigers as through the uncertainties and vagaries of elephantine tempers and irresponsible actions of people on their backs.

In the same year, the first of my tiger shooting career with elephants, there were, besides the charge of Sibjee against Jung Bahadur, two other instances of the kind. One took place at Bijni, the headquarter station of the Bijni Raj: the other at an estate owned by the zamindar of Rupsi. The Bijni Raj was then in the Court of Wards and the Manager had asked Mr. H. of the A.B. Railway and living at Haflong to a small tiger shoot. Both Mr. and Mrs. H. took part in the shoot and though tigers were seen none were shot owing to the small number of elephants available: one howdah and five beaters. Among the elephants was a notorious brute known to have killed some 15 mahouts and grass-cutters. During the beats he behaved himself, but when the party was returning he suddenly charged the elephant in front of him on which was seated Mrs. H. The animals were in single file and H., just behind, shouted to his wife to jump off and she was able to do this before the assault of the charging elephant arrived, falling between the oncoming beast and the one she had left with such presence of mind. I met her not long after at Dhubri and heard from her that she could not remember exactly what happened after leaving her elephant, only that she kept on rolling away. The attacking elephant knocked the other one heels over head, instantly killing the mahout. It was a miraculous escape for Mrs. H.

The other charge took place at a small tiger shoot on the Rupsi Estate when some twelve elephants were out. At the end of the day a male elephant charged sideways at a female, knocking it over. Of the three people aboard one was uninjured, the mahout was killed, and the other man had his jaw broken. Having some knowledge of dentistry I tried to improvise methods to keep the bones together but had to fall back upon the usual treatment which succeeded absolutely—a perfect result. This man could only remember that he found himself mixed up with elephant legs and then became unconscious. He probably received a kick from a forefoot and was fortunate not to be more seriously injured.

The Zemindar of Rupsi, whom I knew well, met his death through avoidable circumstances. The Zemindars of Lakipur got up a shoot to which Rupsi contributed his own nine elephants. With him was a Khasia boy he was supporting and educating. When the Zemindars learned that Rupsi intended to put this Khasia lad into howdah to use a rifle they objected, saying he had no experience and it would be unwise. Rupsi said he was certain the boy could use a rifle as well as any of them and that he would not be frightened if he saw a tiger. After these preliminaries the Zemindars decided to place the lad on the extreme right of the line of waiting guns as they did not expect the tiger to go there, and Rupsi was placed next to him. In Rupsi's howdah was sitting the 11 years old child of an English lady, the wife of one of the Zemindars. Things will happen, 'Kismet' one can call it. As soon as the line of beating elephants advanced the tiger was seen to be moving in the direction of the Khasia boy so Rupsi, an experienced sportsman, seeing this, moved down to the lad's elephant but was too late to steady the boy and give him confidence. The tiger was seen by the lad, who panicked, brought up his rifle in direction of Rupsi instead of the tiger, and pulled the trigger. Poor Rupsi was killed instantly, the high velocity bullet passing through his arm and on through the chest. In doing this it went very close to the small girl sitting next to him. A terrible experience, for she was drenched in his blood. We were on our way to a shoot with the Rajah of G when I met his Dewan who told me all this, at the same time informing me that three of G's elephants had gone *musth*, and in addition that a known bad elephant had escaped from the Zemindars' camp some forty miles away and was reported to be making towards G.'s camp.

Having heard all the news I drove on in my car and got into a bad bit of road where the car became ditched. Some villagers were yelling that the musth elephant was coming across the plain and I found the car could not be re-started. With me were .475 cartridges but the rifle had gone in advance to the camp; so we took suitable cover to see the elephant take no notice of the car and proceed on down the road. Were we relieved! This was a female called Megmala. Had I known that in time I might have been able to stop her and ride her to the camp.

The car was started without difficulty after it was found that my wife's handbag handle had slightly turned the switch key! When we got to R's camp we found there had been yet another tragedy. The Rajah of G had been out looking for tiger tracks and village 'Khubber' and somewhere about midday his mount Sibjee charged this female elephant Megmala from behind, knocking her heels over head and instantly killing the mahout. I saw the dead man; a good mahout whom I knew well. Megmala made her way across country to Gauripur, swimming the Brahmaputra on the way. For many years she was G's best howdah elephant but having been badly mauled by a wounded tiger could not, after that, be depended on.

That night I took my .475 (in case of accident!) and went to see the three musth animals picketted about a hundred yards from the tents. Had one of these broken loose that dark night there would indeed have been trouble. The shoot was abandoned and being late in starting we did not catch the ferry, so returned to the Fakirganj Inspection Bungalow for the night. Our slumbers were not sound as Sibjee and the musth elephants were tethered in the compound! Glad indeed were we to return safely next day to Dhubri. Can tiger shooting off elephants be dangerous?

There will be more 'incidents' in course of these reminiscences, but at this point a method of shooting tigers off elephants which affords good sport and is not ordinarily dangerous may be suitably mentioned. The requirements are two reliable elephants, one for the sportsman, the other for two shikari attendants and to carry the bag to camp. A 'Charjamah' which is a pad having low rails is better than the more cumbrous howdah, which is not suitable for forest work. The method requires that the sportsman should be thoroughly acquainted with the habits of tigers; should know the language of the countryside; have a good manner in dealing with the people; and be not too niggardly, or the reverse, in payment for services rendered.

Where wild elephants are not uncommon all jungle animals are easily approached, and it is by quietly wandering along in the likely places, especially in the vicinity of any kill the whereabouts of which may be indicated by crows, birds of prey, or vultures, that tigers may be shot out of hand without incident, or may sometimes be moved out of cover by the pad elephant. Should the tiger be wounded there may be plenty of incident, but the sportsman is at any rate not in peril from actions of other elephants or sportsman. Silence on the sportsman's elephant is essential: any instructions to the other elephant being by whistle or signs, or signal horn when really necessary.

In course of Shikar of this description much jungle life may be observed—life of animals, birds, and insects which would otherwise never be seen, for it is a leisurely affair with plenty of opportunity for observation. It is not too much to say that a week of such hunting will furnish more experience of nature in the jungle than many 'shoots'. Elephants can be used with much success for fishing in deep and rapid streams where dug-outs or other boats are not easily obtained, carried, or used. From elephant back many places otherwise quite inaccessible owing to trees and riverside jungle growth can be well fished, and return to camp made without trouble. On such excursions a rifle or gun is usually taken in case of need as, apart from some chance opportunity of bagging a feline, the camp larder needs replenishing both for oneself and one's followers.

Howdahs in use over eighty years ago, as seen by illustrations in shikar books of those and earlier days, were of better design than many in use at the present time. There were, as there should be, places—racks—for several weapons on either side of the occupant of the front seat in the howdah. All sportsmen of experience say that more than one weapon is essential for howdah work, and one of these a shot gun. The Rajah of G always had 4 weapons with him and sometimes as many as six; but as many as that may be thought unnecessary.

A shot gun is advisable as, when a tiger is on the elephant, and perhaps trying to get into the howdah, a charge of shot is sufficient. On one occasion when shooting off Sibjee the Rajah was following a supposedly wounded tiger which was, however, unhurt. The tiger was a bad tempered beast and charged several times, being missed on each occasion owing to Sibjee dancing about. Eventually Sibjee turned and bolted or rather, as G said, the mahout it was who turned tail. The rampaging tiger followed apace—the whole shooting party seeing this wonderful show—caught up the elephant, jumped on from behind, and tried to get into the howdah. The Rajah had trouble with the occupant of the rear seat who lost his head and would not keep down, so the first essay with the shot gun was a miss. The noises of it caused the tiger to quit but he followed along and again got on to the elephant. By this time the back-seater was frantic and as G explained when it was all over, only by keeping the man's head down with his hand was it possible to use the gun. To use the weapon with one hand while the elephant was running as fast as it could was almost impossible; however, by pressing his knees against the howdah to steady himself as much as possible, he was at last able, as the tiger's ferocious head came over the howdah rail to place the muzzle against the beast's neck and press the trigger. So all was well.

This has been a long digression from the subject of howdah design but has an important bearing on it. I have seen a number of howdahs which are fitted with doors to admit of easy entry on either side. These doors sometimes fly open. Had that happened in the above encounter there would have been certain tragedy. In earlier days G's howdahs, and those I have seen on elephants of two Maharajah's had side doors, and were also too low front and back. A man sitting or standing in those howdahs was certainly not really safe as it would not take a great deal of movement on part of the elephant to toss him out. An instance was what happened to Captain R, then a Civil Surgeon. He was invited by the Rajah of G to a tiger shoot and while taking aim at an advancing tiger about twenty yards away his elephant suddenly lurched forward, causing him to hit against one of the doors which opened and shot him out somewhere near the tiger! G laughed at it afterwards, as R shinned up a small tree near by with the agility of a monkey; but it was no laughing matter at the time. After that occurrence G had all his howdahs altered to a fool-proof design.

Things may happen which put howdah construction to the most extreme test imaginable. Even when the elephant is tumbled on to its side it is possible for the sportsman to remain in the howdah, but only if it has high sides and no doors. This was the way of it.

The M brothers are two of the nicest men one could meet, both of them very good shots. They have seen hundreds of tigers killed. On one occasion a large tiger pressed home his attack, landing on the head of the elephant on whose back was M senior. The elephant sank on one knee, which is their habit in an endeavour to kneel on the tiger and crush it. The tiger jumped on to the ground and with its forearms round the head, before the elephant could stand up, pulled it over on to its side. M's rifles and ammunition fell out of the howdah and it was with difficulty he remained inside, but he managed to do so by holding on to the rails. Three times the tiger pulled the elephant over. M still in the howdah, when finally, for no reason that could be imagined it suddenly abandoned the fight and was shot by other guns on nearby elephants. Things occur so rapidly in cases like this that it is impossible to see in detail what actually takes place. Only a cinema picture could show that, and changes in position take place so rapidly that it was not possible for guns on other elephants to risk shooting. In after years M was often asked what it felt like when the elephant went on its side with the tiger in touching distance. 'Yes', he would say, 'it was very touching, and I hope if it happens to you it will develop your sense of humour'. He himself had sense of humour particularly developed.

In a book 'My Sporting Memories', by Major General Woodyatt, it is said, 'a tiger, though spined, struck a tusker elephant with its paw with such force that 2 claws were actually embedded in the elephant's thigh.' When told of the above the Rajah of G. remarked, 'Quite true. I have seen something similar. I once wounded a tiger at the end of a field, just short of the edge of heavy jungle. He was hit far back and the spine was broken. I pushed my elephant along and as I got close to him he was in a sort of sitting up position. I was preparing to kill the tiger when I saw to my left a number of tame buffaloes, among them an enraged bull pawing the ground and making ready to charge. Wishing to see what would happen I held my fire and to my surprise the bull actually charged the tiger which, in his crippled condition, waited until the bull put his head down. Then the tiger with a smack with one paw and a turn with the other knocked the buffalo over, killing him instantly. I could not believe the bull dead and waited for him to rise. Having killed the tiger we found the vertebrae of the neck had been dislocated'. I have read in shikar books of tigers, when breaking back through beaters, smashing a man's head like an egg-shell with a mere passing tap with a paw and can well imagine it happening: indeed, Mr Hazlitt, I.C.S., who was the Superintendent of the Lushai Hills, told me that he actually saw this happen. A tiger was seen to jump over the spot where an old woman was collecting firewood; when the party got to this place the woman was found dead with a fractured skull. As he jumped over he had just hit the head with his paw.

Most people having acquaintance with elephants know how much they dislike dogs, especially yapping ones of the small terrier variety but there are other animals equally obnoxious to them. In beats for tiger I have seen them show fright of even rats which run squeaking out of the cover, and they have a marked dislike of wild pig, even giving the tiger sign—the metallic rap of the trunk on the ground with the accompanying low rumble, on their approach. At times they will even turn and run away from these small creatures, even rats!

One speaks of an elephant being perfectly steady but what is meant is that he will stand without movement, his mahout having given him the order by recognized pressure of knee or driving-hook, for the actual shot to be taken, a matter of a few seconds. While waiting for the beating elephants to approach he is constantly moving his ears and tail and shifting his weight from one leg to another, also swishing his legs with tufts of grass etc., to keep off flies: all this ceases for the taking of the shot; that is, it does when the animal is properly trained. A mahout will often be dozing during a beat but is wide awake when the time comes to be alert, and in any case a touch from the sportsman is sufficient warning. Just as a nervous rider will communicate his condition to his mount so will a mahout to his elephant. A good mahout will have a steady elephant as the sagacious beast soon knows he can trust him.

Bees and hornets may at any time be met with so a blanket is always carried. Blankets are also of use to quieten excitable animals, for even elephants becoming musth, if taken in time, can be controlled by a blanket over the eyes, thus averting possible serious consequences. Mahouts like the fun of tiger shooting and will deliberately leave camp on 'musth' elephants. It may be in case of beating elephants that they wish to enjoy the sport, for they all get an allowance whether staying in camp or not; and the drivers of howdah elephants are reluctant to forgo the chance of an extra ten rupees should the tiger be shot from their howdah. It behoves the organizer of the shoot to be always on the watch for an appearance of 'musth', and it is well for sportsmen also to be able to recognize the signs.

I have mentioned in connexion with the shooting of a rogue elephant that the right striker of my .475 H.V. rifle was found to be broken and that of course might have had serious or fatal consequences. Had I tested the rifle before setting out this would have been known. Such a thing should never occur, for it is so easy to make the necessary tests before putting the weapons away after cleaning. Dummy cartridges should always be used in hammerless weapons to guard against strikers being broken or damaged by snapping against no resistance. Before putting away hammerless and ejector weapons the springs should be eased; and it is seldom that the owners of ejectors know how this is done. Ejector springs cannot be expected to work for ever if put away at tension for months on end.

There is no doubt that a double barrelled rifle is better than a single for howdah shooting. The great advantage of the double is fully realized when a second shot has to be immediately taken. The few seconds longer needed to get off the single weapon may be all important; the bagging of the tiger or not. Shots at the head should be avoided. From elephant-back the plunging shot between the shoulders is always fatal, that is if the bullet is what it should be. One of the secrets of successful tiger shooting, whether with elephant or with men, is never to hurry the animal, which ought to be brought to the waiting gun as unalarmed as possible so that a quiet unhurried shot may be taken, the angle being judged so that the bullet will find a vital place. Further dissertation as to shots to take and weapons to use or not to use must be held over to another time.

This rather rambling writing may be closed with some tales which occur to me as being perhaps of interest to the reader. Mr de C. was an Assam Police Officer who stood no nonsense, a man of action, if sometimes a little eccentric in some things. I can vouch for the following. He and a Sub-Inspector were in a hole in the ground waiting for the return of a tiger to his kill. The tiger was dragging the kill away in the darkness when de C got out of the pit, ran towards the kill and as soon as he was able to get his torchlight to bear killed the beast with a shot in the chest. This detail was given by the Inspector. On another occasion de C. was asked to witness the enclosure of a tiger in netting, a method practised in other parts of India also. He went with the Inspector of Police to see the fun. This was in the Dibrugarh District. He and the Inspector were standing very near the netting when the tiger suddenly charged and though it did not break through it tore the Inspector's coat and inflicted some scratches. This was too much for de C. He took an old D.B. 12 gauge shot gun from one of the villagers, put some shot cartridges in his coat pocket, loaded the gun with 'Lethal' bullets, raised the lower edge of the net and walked in. He had not gone far in the direction to which the tigress—for it was a female—had retreated when she charged at him belly flat to the ground, as he described it and as I have several times seen—no bounds or jumps. Before she reached him he shot her dead. Good work. He was making sure the tigress was dead when he was charged by a wild boar. He had just time to jump to one side and fire as the pig passed. The boar turned and again charged, but waiting until there could be no miss or ineffectual shot he killed the animal almost at the muzzle. Again good work. By this time the fore-end of the old weapon had dropped off and, without noticing this he reloaded with shot cartridges and leant the gun against the pig's body. How it happened he cannot say but both barrels went off and peppered some thirty coolies. Not such good work! Fortunately the distance was such that the pellets only penetrated skin deep. It was always a great joke: de C. bagging on one day a tigress, a boar and thirty coolies. But it was no joke at the time and the affair eventually cost de C. about a month's salary one way and another.

(*To be continued.*)

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. St. J. Macdonald.

(*With* 9 *text-figures*).

Part IX

(*Continued from page* 321 *of volume* 45).

TANK ANGLING

The fish (1). Best places to fish (2). The Bottom (3). The Rod (4). Hooks (5). The Float (6). The Mount (7). Machan (8). Depth of water (9). Ground baiting (10). Method of Fishing (11). Bait (12). How fish bite (13). Striking a fish (14). Playing a fish (15). Shelving banks (16). Season and Time (17). Cutla fishing (18). Mr. Corbet's note on Cutla (19). Mr. Kitchen's note on Cutla (20).

Tank Angling for Labeo.

In this chapter I propose to deal briefly with bottom fishing in tanks for Labeo, Mirgil, and Cutla. For those wishing to further their knowledge I strongly recommend Thomas' Tank Fishing in India or better still Hints to Amateurs in Tank Angling, by P. N. Bhattacharyya, which cover the subject fully. Fishing for the predatory fish in tanks is dealt with in Chapter VII.

Although Mahseer rightly take pride of place with the angler in India, circumstances may not always permit or satisfy his wants. He may find himself stationed hundreds of miles from the nearest Mahseer water, with little opportunity of getting away. It is under these conditions that he has to turn to other fishing if one is still to enjoy the sound of a singing reel. The Rohu or Labeo and his two cousins run large and are strong fighters, and no mean game. Do not be discouraged by the Mahseer conquerer of fly fishers scorn, laughing down bottom fishing. If once tried to success you will be converted. These fish are to be found in tanks within easy distance of almost any decent sized town in the plains of India.

The method of fishing is a technique worthy of the best elements of angling, and on entirely new lines, to that of the float fisher in other countries.

Before settling down to the vigil of the float, standing upright, and only one inch out of the water, let us consider a few general principles, and why this is different to other forms of fishing.

The Fish.—The mouth of the Rohu (*Labeo*) is ridiculously small for his size but is well provided with taste buds, and situated well below the head. The same applies to the Mirgal, but to a slightly lesser degree. The Cutla has no taste buds, but a large mouth badly put on with no upper lip, thus causing the mouth to open upwards. This makes them all feed and take bait in a similar manner, i.e. by sucking in their food, much as a puppy does, when feeding from its mother. Their natural food appears to be slime and weed on or near the surface, and organic matter on the bottom; but paste and worms are readily taken, and provide an ideal bait.

It is to the peculiar nibble with which these fish take the bait, that tackle has to be adapted, in order to detect the slightest movement of the baited hook.

The float must be light and sensitive, a porcupine quill or the tail feather of the Peacock cut to a suitable length and bound with silk do excellently when adjusted correctly so as to register the minutest bite.

2. *The Best Places to Fish.*—Time spent in the selection of firstly the tank, and secondly the part of the tank, is well repaid.

Old tanks with weeds or masonry walls or steps, that are land bound with no water escape, will generally hold good fish. This is provided it is protected from netting and does not dry up in the hot months.

Having selected an old tank and satisfied yourself that it holds *Labeo*, the next point is to select a suitable place from which to fish, and erect a machan, if you can reserve a place for a fee.

Here are just some of the points to consider in the selection of a site.

(1) Avoid sitting with the sun in your eyes, and as far as possible select a part of the tank shielded from the wind.

(2) The bottom flat and firm, at a depth of from 4 to 6 feet.

(3) Should there be a *Ficus* tree overhanging the tank, select it to fish under. All fish are attracted by ripe figs or berries. Bathing ghats; where pots and pans are washed; near masonry walls or steps; at the entrance of water feeder channels,—are all good places to select.

3. *The Bottom.*—Survey the bottom with a plummet, and whereever possible select a flat portion, this is very important for the correct adjustment of the line and float. Most tanks are however basin-shaped with shelving sides, special adjustment to the float must be made in such cases. (See Fig. 8).

Having considered the fish and selected the tank and fishing site, we will now consider tackle.

4. *The Rod.*—Cheap ringal rods can be obtained in the bazaar of any decent size town, their price, mounted and fitted with rings, is only Rs. 4 or 5. Better rods can be had from any of the tackle makers. Ten feet or so is quite long enough, it must however be

fairly stiff for brisk striking, the same as a casting rod, on 'Wee Murdoch' lines.

Cheap brass reels can be had for Rs. 10 or so, and are good enough, with 100 yards of line.

Twisted or plaited lines can be had for Rs. 4 or Rs. 5 per 100 yards. The Tussa silk lines are the most favoured, as they are elastic and give with the strike which is necessary. They are cheap and very strong. Any good line does. I myself favour a smooth green or black line, not the khaki colour, and rough coil of the Tussa which must set up reactions in water.

5. *The Hooks.*—The short shank variety is the best for this form of fishing, and the types made in Calcutta and stocked by Mantons and called 'For India' are as good as any. I like Hardy's best. I give here a diagram of one I had specially made by them.

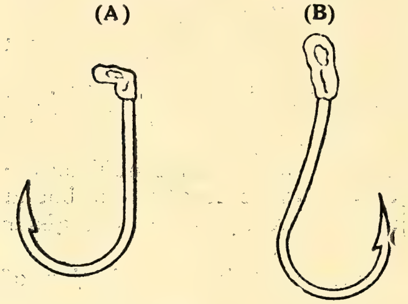


Fig. 1

(A). The advantage of A over B is the short barb to the point of the hook, for easy penetration. And the wide rounded sweep of the hook and turn down eye, for direct draw by the line.

The important thing is a short shank with a sharp point, and a thin short barb. [See Fig. 1 A].

6. *The Float.*—A quill float made up of either the tail feather quill of a peacock, or a thin porcupine quill. In the case of a feather quill, it is made up with fine cotton or silk lashings at intervals of ½ an inch, to enable one to detect the slightest movement of the float. It should be about 4½ to 5 inches long, with a loop at one end a couple of inches long. (See Fig. 2).

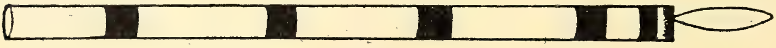


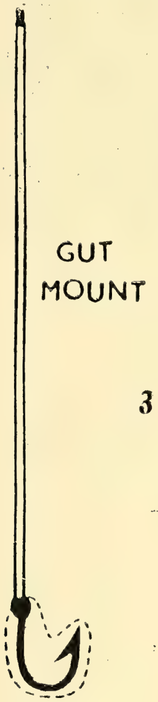
Fig. 2.—A quill float.

The float can be either attached or taken off quite easily, by bending the line double, passing it through the loop and over the end of the float. This gives one a slip knot over the line, so that the float can be run up or down the line to the required depth.

7. *The Mount.*—For very clear water, a good mount is a single hook mounted to a couple of lengths of stout gut, with a small lead, the weight of 2 or 3 B.B. shot. In coloured water, the ordinary mount with two hooks is good enough, mounted on to line. This then completes the outfit, the whole of which should be obtainable for Rs. 30. (See Figs. 3 and 4.)

8. *The Machan.*—These can be made from either bamboo or timber, though the latter is the better, and this I consider the most important factor to success. The machan must be *rigid*, as however expert one may be at sitting still, there are times when

movement is necessary and if the machan is not quite rigid on its supports, fish are frightened away; the lower the platform is to



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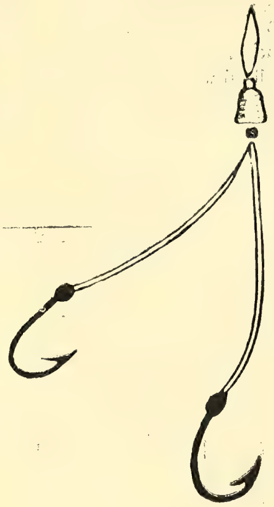

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Fig. 3.—Gut mount shelving banks or clear tanks.
Fig. 4.—Two hooks for flat bottom fishing.

the surface of the water the better. A small footway connecting the machan to the bank, should not be attached to the machan, but a small gap left between, so that if an attendant brings any-

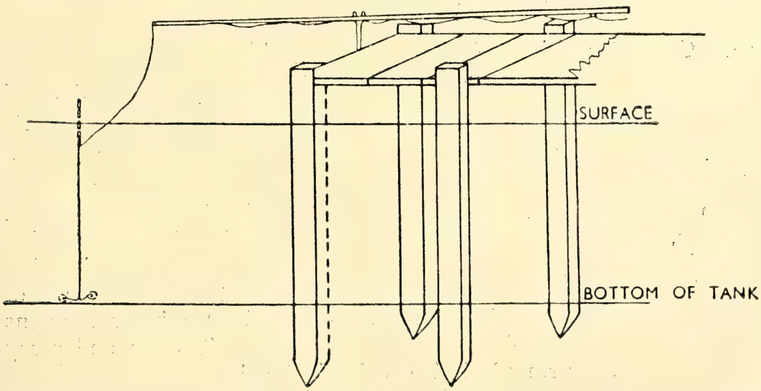

Fig. 5.—Machan showing rod rest, point of rod, float in correct position and directly over bait.

thing along to you, while you are fishing, his movements are not taken by the posts of the machan. A small stool or chair of any kind, and a rod rest completes the outfit, and we are ready to make adjustments of our fishing gear. (See diagrams 5 & 6.)

9. *Depth of water.*—This is the first thing to be done. A careful reading is made of the depth of the water, and the float adjusted to stand vertical in the water. If the bank is shelving one must consider the exact distance each time to lower the bait, and the baited hook must be dropped in directly over, or you will find that the line is not vertical from the float to the hook, a most important detail. (For proof of this see Figs. 5 & 8.)

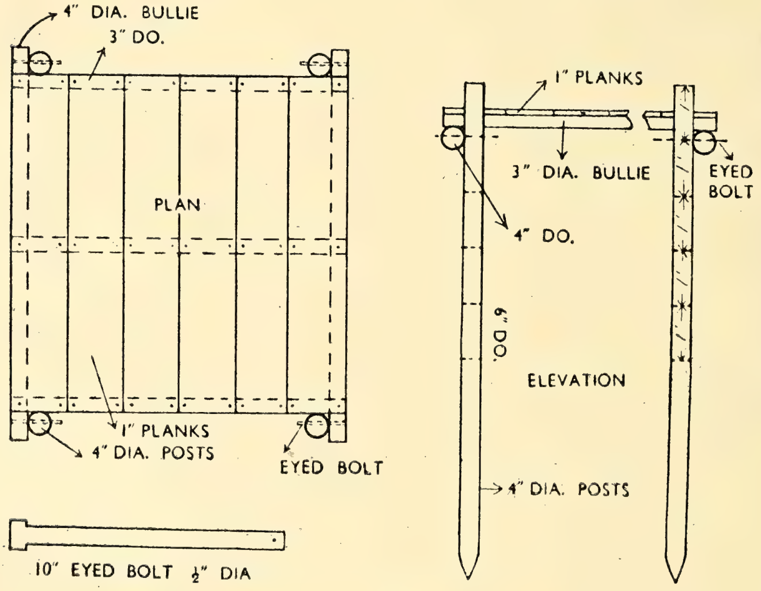

Fig. 6.—Adjustable fishing machan.

10. *Ground Baiting.*—There are many kinds of ground bait; oil cake either mustard or castor, fried or fermented is good. Mix it with mud or gram or atta or rice, and throw it in. A large variety of ground baits can be bought, if one is foolish enough to do so. I myself think, provided the machan is a good one, the bait is a secondary matter, and the best and most pleasant bait to use is roasted mustard cake, mixed with bran, damp earth and water, made up into slabs 4 to 5 inches in diameter, and a couple of inches thick. Mix in the proportion of 2 parts oil cake, 2 parts bran, and one part mud. I say in flat cakes because of the usual practice of making balls. These, if the bank happens to shelve towards the middle of the tank, will roll down and away from your fishing ground, if the cake is hard.

A cone-shaped weight, with a cork strip let in, and a loop at the top, is best, and the most convenient plummet, but any weight will do equally as well. A 'Hillman Lead' for instance,

11. *Method of Fishing.*—The points to attend to then are:—

(1) Ground bait for 3 or 4 days before you attempt fishing, depending on the size of the tank.

(2) If the bottom is soft and muddy, a good dodge is to drop in a few baskets of gravel, and have it settled on the bottom by some local fishermen, Malars or any other of the tribe who can dive, this is a precaution well repaid, and is besides an attraction to the fish. Only 3 or 4 sq. feet of bottom need be prepared in this way, so that the baited hook will not be obscured from view, by sinking into the soft mud.

(3) Next get the correct depth in a vertical line from your float to the bottom, by means of the plummet. This should be adjusted, so that the float is ⅔ under and ⅓ out of the water, or as near as possible, with the sinker just resting on the bottom. (See Fig. 7.)

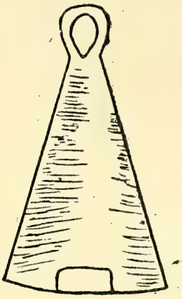

Fig. 7.—Plummet.

(4) The float should be as near and under the point of the rod as possible, with the head line reduced to the minimum. This enables one to instantly strike a fish. It will be seen later that this is of great importance. The weight of the baited hook should be greater than the resistance of the float. That is, if the line connecting the float to the bait is less than the depth of the water, the float should be carried under water. This is important.

12. *Bait.*—The usual bait is paste, either flour or atta, or nice red worms. There are many others besides. Adding smelly stuffs to the bait, onion juice, turmeric (huldee), asafoetida (heeng) and numerous others; dried weed powdered and mixed with gram flour is supposed to be good for *Cutla.* Whichever is selected, should be prepared in the manner I have suggested for mahseer fishing, by boiling it a few minutes, when it gets nice and sticky, and will not leave the hook so easily as if it were not so treated. Mixing cotton wool is another dodge, a bait little known is the leech. It is a lively worm and takes excellently, only give a fish lots of time before you strike.

White ants or wasps' eggs are sometimes fancied. The variety of bait used by the Bengali and the Mohammedan would fill a book; let us select from this humble list, one of the few mentioned.

13. *How Fish Bite.*—The idea of so sensitive a float, is to register the slightest nibble of the bait, these fish bite in a very delicate manner. The first indication of the fish at the bait, is that the float moves slowly, either up or down, this being followed by a number of bobs, moving perhaps half an inch in either direction, or even less. Strike when the float is going down, or when the fish is sucking in the bait. The other signs are, float slowly disappears or lies flat on the surface, both are indications to strike, and more satisfactory than the first mentioned. In the second case, the fish has lifted the bait into its mouth and is moving off. A third, is the fish lifting the bait off the bottom, and taking the weight of the sinker off the float by moving upwards. Strike hard.

14. *Striking a fish.*—The more pliable a rod the less chance of breaking your line in a strong strike, which must be sharp and firm, to send your hook home into the tough mouth of the fish, and it must be quick or the fish expels the bait from his mouth, as soon as he feels the drag on the line. Too stiff a rod will cause breakages, which occur in the most mystifying fashion. You strike but do not feel the fish, yet the line snaps. The best way, I think, is to strike off the reel, provided you have a strong check. Do not hold the line against the rod when striking; with sharp hooks a single-handed strike is quite sufficient to drive the hook home.

15. *Playing a fish.*—If possible move away from the machan, so as not to disturb the baited ground. A landing net or an attendant can then fix your fish for you. The Rohu goes off with a strong rush when hooked, and will sometimes jump out of the water. The Mirgil often comes to the surface on being hooked, and remains there a few seconds, before dashing off.

16. *Shelving banks.*—If the tank has a bottom falling away to increasing depth, I have found that the small weight can be dispensed with, and a very light and long float used, say 10 inches. Allow the bait to rest on the bottom, with the float as much out as possible, the object of the large float is obvious, and reduces the error of exactness in lowering the bait. Frequent striking is necessary, under these conditions, or the bait gets carried down beyond the registering depth of the float. (See Fig. 8.)

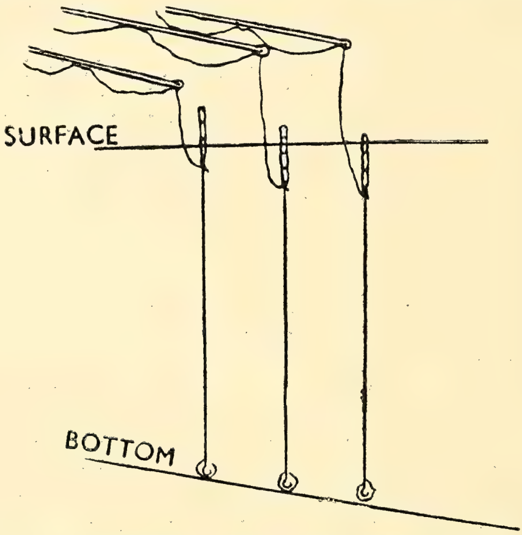

Fig. 8.—Position of float alters with position.

17. *Season and time.*—This is a matter of local conditions. In so vast a country as India a general remark is all that is possible. The rains is the best time, when the fish take fairly regularly, almost all day; in the hot weather the morning and

evening at the changing of light, appears to be the best time, from 5 to 9 a.m. and then again from 4-30 to 7 p.m. or until it gets dark.

I hope that this brief description of the methods, aided by the diagrams, will acquaint the reader sufficiently with this form of fishing, and that it will help him to success. They are no mean game, either in circumventing or fight, and well worth an afternoon's sport, for they will steal your bait, and tax both skill and patience to the utmost.

18. CUTLA FISHING

The Cutla is to be found in most tanks where one gets Rohu and Mirgil and attains a greater size than either of the two fish just mentioned.

It is rarely caught hooked in the mouth; I have never caught one, though I have fished in tanks where they were plentiful, and attained a huge size.

The methods of foul hooking, used by Bengali gentlemen, who incidently are masters at this form of fishing, are fully described by Mr. Bhattacharyya in his book, and in Mr. Kitchen's Note.

I am indebted to Mr. A. Corbet for the following Note on Cutla fishing, and can thoroughly recommend it to all tank anglers. Mr. A. Corbet has caught more large fish in tanks than any one else I know.

19. CUTLA FISHING BY A. CORBET

'**Cutla buchanani.** U. P. 'Boassa.'

Teleg., *Botchee, Punj. Taila,. Bom.; Tambra. Behar, Bhakur.,*
Hind., *Bing., U.P. 'Boassa.'*

'Usually found in all tanks throughout India. Represented by only one species.'

'Like a carp in appearance, but much more heavily built, and attaining a very large size, sometimes about 100 pounds. Very large head, the length of the fish is usually three times the circumference of the head, broad snubby snout, mouth turned upwards, with no upper lip'.

A bottom feeder, like most other tank fish, and not quite as shy. Often known to take bait within a yard of the bank, in three to six feet of water or deeper. Its nibble is shy and gentle.'

'A spot or "char" should first be selected in the tank, preferably where the water is from 3 to 7 ft. in depth, and the bottom for about 12 ft. out and 5 ft. across be thoroughly cleaned of all grass and weeds, also of all black or ponky, rotted earth, found in most tanks.'

'Liberal ground baiting is necessary, and there are several highly vaunted nostrums for this purpose. A few of the most successful used for attracting most kinds of Tank fish, are—fried mustered oil cake (khulli), teemul, methi, mumgreilla, and jeera.'

'A small portion (about 1 oz.) of each of the last four named ingredients should be fried and pounded, and mixed with reddish earth (Chikna Mutti), the fried mustard cake can either be crushed and added or thrown in whole pieces of about ½ pound in weight.'

'The mixture of earth and ingredients should be made up into small flat cakes, the size of the palm of the hand, and thrown into the fishing "Char".'

'The baited hook should rest on the bottom, where the ground bait has been laid.'

'Tank fishermen are always pestered by turtles, prawns, or crabs. A good method of keeping the first two away from a fishing "Char" is to fill a bottle straw with any old raw meat or chicken entrails tying up both ends attach a stone and sink about 10 ft. away on any side of your "Char", this will keep them busy most of the day.'

'A handful of "Dhal" thrown around your bait, is useful in keeping away crabs.'

Bait. 'Most kinds of paste bread, boiled flour and atta from preference. Before the monsoon when the water in tanks is low, and not too clean, some honey mixed with the paste bait, preferably flour, which is the whitest bait, is recommended. Cutla seem to be attracted by most highly scented baits, and during the Jack fruit season, a couple of dozen flakes thoroughly ripe, mixed in with the ground bait, is a most successful lure. Slight flavouring of the same fruit, used in the hook bait or paste, adds to its effectiveness. Besides paste bait, cutla and other tank fish will take wasp and bee grubs, maggots, sometimes worms and pieces of raw prawns.'

Tackle. All that is required is a one-piece bamboo rod, fairly 'stiff, with some country silk tussore line, preferably mooga four ply, medium thickness. Special modern rohu hooks, easily obtained these days, and a peacock quill float about 6 inches in length'.

Mr. A. Corbet has not detailed the method of fishing, but this is the same as mentioned earlier in this chapter, for all bottom feeding fish.

I am also indebted to Mr. P. H. Kitchen for the following note on Tank Fishing. Mr. Kitchen is an experienced angler, and sent me besides some very interesting notes on Mahseer fishing in Burma.

His note on the Cutla is most enlightening and the ratio of Cutla to the Rohu and Mirgil he has taken, is better than I have had the good fortune to experience. I have caught scores of Rohu and Mirgil, several over 30 pounds, but never a Cutla, although I have fished in tanks where they were both numerous and large.

20. TANK FISHING BY P. H. KITCHEN

"With 18 years' experience of tank fishing between Calcutta and Hazaribagh I would unhesitatingly advise the angler who aspires to even moderate success in Bengal waters to study the methods of Bengali fishermen, and with but slight modifications to adopt his ways to theirs. With this word of caution I shall proceed to a general description of tackle required and the method of using it.

Rod.—A plain Ringall bamboo, length 10′ to 11′, never more, stiff in the butt, and with a medium pliable top is the best. When such sophisticated and shy fish as Cutla are nibbling, the strike must be as quick as lightning, and a flexible rod would spell failure.

The first reaction to a sharp strike with a pliable rod is that the point bends downwards and strikes the water and the fraction of a second is lost before the point springs back and tightens the line. This means the loss of the fish. When selecting a rod care should be taken to pick one in which the knots are close together, and of which the outer skin is bright and glossy. These are stronger and quicker, and do not warp so easily as bamboos of which the knots are far apart and of a dull appearance. Linseed, or mustard oil should be rubbed into the rod monthly, and if this is done, and granted a rod has been carefully selected in the first instance, there is no reason why it should not last for 15 years.

Such a rod mounted by the angler with which fittings and rings would cost about Rs. 3. Tackle shops would charge Rs. 10 to Rs. 15.

Reel.—3½″ to 4″ preferably of aluminium alloy. Revolving plate, plain check.

Line.—Cotton and flax lines are inclined to swell in water, and are not as good as undressed, handmade, silk Mooga lines the best quality of which costs Rs. 2-8 per tola. These lines are immensely strong in proportion to their thickness and are slightly elastic.

Gut.—Quite unnecessary. Japanese 'Ja-gut' is all that is required.

Hooks.—Short shank, round bend, needle pointed. Genuine Burdwan hooks are the best. Manton of Calcutta stock hooks similar in shape, but the points should be sharpened.

Float.—A piece of peacock quill 6″ long, one end of which should have painted on it 2 narrow black bands ¾″ apart, and the other end furnished with a loop of thin twine for fixing it to the running line. This is commonly known as Thomas 'Detective' float, but was actually in use centuries before Thomas came to India.

Bait.—The first consideration is ground bait.

There are various spices and concoctions, some unmentionably filthy, used for attracting fish, but after considerable experiment I have ruled out all except the following as being essential or desirable:—

(a) Mustard seed oilcake—½ lb.
(b) Maithee seed—1—oz.
(c) Groundnut—4 ozs.
(d) Yellow clay—1 lb.

Pound the oilcake and roast it in an old frying pan until it smokes slightly.

Grind maithee seed and groundnut separately and roast until of a rich, brown colour.

Mix these ingredients with the clay which should have been powdered in a dry state, add water, and knead to a stiff consistency. Break this mixture into lumps the size of billiard balls, and throw into water ½ an hour before actually fishing, and just where the hook will rest at the bottom.

Hook bait.—From June to end of July during the first showers and when water is discoloured, earthworms are as a rule—there are exceptions—readily taken by Rohu and Mirgal. August to end of October, after which tank angling is useless in Bengal, the bait *par excellence* is 'Maitah' or 'Meotah.' Country liquor in Bengal is brewed from fermented rice, and the residue left over after the liquor has been strained off is called Maitah. This should be squeezed on the hook in a lump the size of a marble, and the line carefully lowered into the water. Maitah is soft and flakes off readily, and this should be borne in mind when a fish nibbles.

Depth at which to fish.—This is most important. The hook and a single shot fixed on the snood 6″ above the hook should just rest on the bottom, and the float regulated on the line so that only the bands painted on it appear above water.

Care should be taken to choose a spot where the water is from 3′ to 5′ in depth, and if there are reeds and grasses between the point of the rod and the angler, so much the better. I have heard it advocated that the deeper one fishes the better. This is I think distinctly wrong. Fish particularly towards evening, are inclined to browse amongst the reeds in the shallows and when the water is discoloured. I have hooked a 36-lb. Cutla in 2½′ of water.

When to strike.—It is usually possible to determine from the behaviour of the float, and occasionally from bubbles rising round it, the species of fish in the swim. A Mirgal sends up a burst of small bubbles, a Rohu fewer and larger, and a Cutla one or two very large bubbles. When a Mirgal accepts the bait, the float after one or two slow bobs sometimes disappears from sight.

A Rohu after several bobs usually raises the float well out of, and sometimes lays it flat in the water. Strike to this movement, and the fish is a gift. A Cutla after one or two bobs twitches the float rapidly. Strike hard and quick, and with luck 70 yards of line will be torn off the reel after which a stubborn fight will follow. On one occasion I saw a Bengali Babu strike and play a Cutla from 3 to 5-30 p.m. during which time the line off another man's reel was brought into requisition. The fish scaled 68 lbs. On yet another occasion I watched a struggle with a Cutla from 4 p.m. to 7 p.m. when eventually the sorely tried hook broke off at the barb and the darkness of night swallowed the profanities of an exhausted fisherman.

As a rule when a Rohu is struck he springs clear out of water and then dashes off at a speed which would seem to indicate an urgent engagement elsewhere. He has not however the Scottish dourness of the Cutla. The Mirgal bores deep, but his first rush is not to be compared with that of the Cutla or Rohu. When fishing in tanks equally stocked with Cutla, Rohu and Mirgal one's proportion of fish taken in a season would be approximately Cutla to every dozen or more Rohu and Mirgal. The Cutla is a finnicky brute, and in spite of his big head and mouth he is the daintiest of feeders and a thief so one must not expect to meet very many of these fine fish. The Bengalis have interesting method of fishing for Cutla which I have on occasion seen successful. This method is called 'Char-Kati' and is a poaching dodge pure and simple, but possibly excusable when Cutla of 50 lbs. and more are sucking surface weeds, and no bait however tempting will induce them to accept it.

Strips of bamboo are woven to form a hollow shell, the size and shape of a large cocoa-nut, and a thin bamboo some 6′ in length passed through it. This shell is filled with boiled rice, spices and 'Maitah' after which one end of the bamboo is thrust into the soft mud at the bottom of the tank leaving the other end protruding about 1' above water. The angler then seats himself with rod and line to which are attached 2 or 3 hooks very square in the bend and known as Cutla hooks, and watches the end of the bamboo.

When this twitches it indicates a fish nosing around and trying to get at the tit bits in the bamboo shell.

The hooks are carefully lowered until approximately under the fish, when a hard strike may result in it being foul hooked (Fig. 9)."

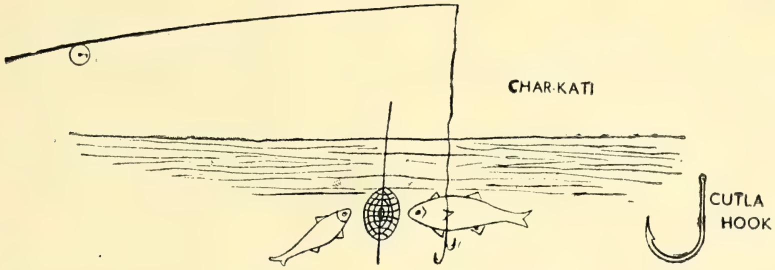

Fig. 9.—The 'Char-Kati' in action.

I have little to add to these notes except to say that a sound knowledge of the Code of the peacock quill, perfect co-ordination of eye, brain and wrist and patience in broiling sun or pouring rain are essentials to success in tank angling. The man who would 'chuck and chance it' had better stick to his spoon and rapid in some brawling Himalayan stream.

(*To be continued.*)

THE SENSE OF SMELL IN SNAKES.

BY

CAPT. ALLEN PAYNE.

(*With* 2 *plates and* 1 *text figure.*)

INTRODUCTION

The senses in the order Ophidia are very interesting, inasmuch as one finds according to the demands of food, protection, social life and the like, that one or more of the senses is to some extent exaggerated to compensate for the lack of, sometimes complete lack of, a particular sense.

This is most conveniently illustrated in the case of snakes by the fact that although a snake has no external auditory meatus and is to all intents and purposes quite deaf, they do possess a most uncanny sense of so-called 'hearing'. This is probably due to a very highly developed sense of 'feel'; nerve endings in the epithelium, scales and rib endings are developed *in excelsis*, even to the extent of recording minute vibrations. This high development and distribution of the nerves together with a very keen power of sight and extensive field of vision, is without doubt compensatory for the snake's deprivation of a sense of hearing.

Some years ago I interested myself in the sense of taste in snakes. As I was at that time in the United Kingdom, my specimens were mainly obtained through the kindness of Dr. Burgess Barnett, at that time Curator of Reptiles at London Zoo. I was able to obtain python's heads from which I removed the tongues and prepared histological sections. These stained with haematoxylin and eosin did not lead me to believe that the python possessed any appreciable sense of taste as there was no evidence of the presence of taste buds in the epithelial layers. No doubt there is some other more highly developed power vested in pythons to compensate for this too.

A. F. Abercromby writing from Travancore on the 12th July 1921 to the Bombay Natural History Society[1] mentions that 'it is however doubtful whether the snake possesses much, if any, sense of taste'. He also mentions instances of snakes swallowing pieces of cloth and in one case a stick, which had recently been in contact with and absorbed the scent of rats. A most extraordinary appetite and palate! He was of the opinion that the snakes appreciated the smell of rats and took these articles to be them. The same writer records an incident of a python seizing and swallowing a rug. These observations however, do suggest a very powerful sense of smell in snakes.

It is well known from field observations that certain snakes quite definitely stalk their prey. The snake will be seen to make a meandering course, frequently flicking its tongue at objects and then proceeding on its way; eventually the snake will catch up with its objective and then depend on its keen visual powers and agility to effect capture.

Opinions are divided when it comes to the true function of the tongue, but in my opinion quite strong evidence is at hand to suggest that one of its major functions is the conveyance of scent spoors through the palatine openings into the internal nares.

In the same communication, Abercromby says, 'at any rate the tongue appears to act as the carrier of the scent to the nostrils'.

Reference should also be made to a most interesting paper presented by A. G. L. Frazer, I.M.D., on 'The Snakes of Deolali',[2] which includes an item, 'Note on the peculiar use made of the tongue by snakes and some lizards'.

He writes: 'A striking feature in the behaviour of a snake is the peculiar use it makes of its tongue. The cause of this seemingly purposive act is not generally understood. . . . The habit as noticed amongst the Ophidia synchronises with the exercise of muscular activity, such as locomotion, or when in the case of the cobra, the hood is expanded and the anterior third of the body is erected. It is only in these active states that the creatures shoot out the forked tongue in quick succession. The act appears to be in the nature of a physiological expression of some function serving to their benefit. The author is unaware of any scientific explanation for this characteristic behaviour. Any theoretical consideration offered in elucidation of the act must necessarily be advanced on some physiological ground. . . . Snakes being cold-blooded, their temperature varies with the surrounding medium and is normally a degree or two above it. Any muscular output is always attended by heat production in the tissues and there must be some means for eliminating the heat engendered, especially in an animal which is totally unprovided with sweat glands. In view, therefore, of the fact that the act is a spontaneous one and associated with muscular activity alone, there are tenable reasons for believing that the heat formed in the tissues is got rid of by evaporation of the moisture from the extruded surface of the tongue.'

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[1] *Journal, Bom. Nat. Hist. Soc.*, vol. xxviii, p. 812.

[2] *Journal, Bom. Nat. Hist. Soc.*, vol. xxxix, p. 58.

This is yet another theory of the function of the tongue, but I feel that the tongue has a more powerful role to fulfil in the life of snakes and it was the idea that the tongue is very closely connected with the olfactory organ that activated my interest to study the subject.

The following paper is a short study then, of the sense of smell in snakes, carried out over a period of about a year. The area from which I have drawn my specimens has been the United Provinces—mainly Lucknow district—and the species I have dealt with throughout the study has been the Common Krait (*Bungarus caeruleus*) as these are in abundance in this area and as I had promised to collect them in numbers to send to the Haffkine Institute, Parel, for antivenine research.

The major part of the investigation is based on twelve males and twelve females captured at village Kakori, U.P. The ages ranged between one year and two and a half years, and the males were between about three and four feet in length and the females two to three feet eight inches.

To make the discourse and the diagrams more clear, I have outlined very briefly the general anatomy and physiology of the organs of smell in snakes, and made special anatomical and histological observations in the case of *Bungarus coeruleus.*

Anatomy.

In any living creature the gustatory apparatus proper accommodates four main sensations, namely sweetness, salt, sourness and bitterness. These four sensations are but a mere portion of the wide range of sensations generally classified as taste. The appreciation of taste and smell is jointly derived from the sense of smell, which is subserved by the olfactory nerve.

Generally the organs of smell are two rather irregular chambers enclosed by the nasal capsules. These chambers are paired and separated by the nasal septum and are communicated with the internal nares; the linings of which are in connection with the olfactory nerves of each appropriate side.

In Ophidia, Jacobson's glands are present; these are situated between the nasal sacs and the palate, that is to say, between the turbinals and the vomer. They appear as a pair of sacs having an olfactory epithelium, and are actually outgrowths of the nasal sacs, innervated by the olfactory (and trigeminal). They open into the mouth immediately in front of the choanae and as such are considered as secondary olfactory organs specifically developed to serve the mouth. (See plate and diagrams of the mouth and skull.)

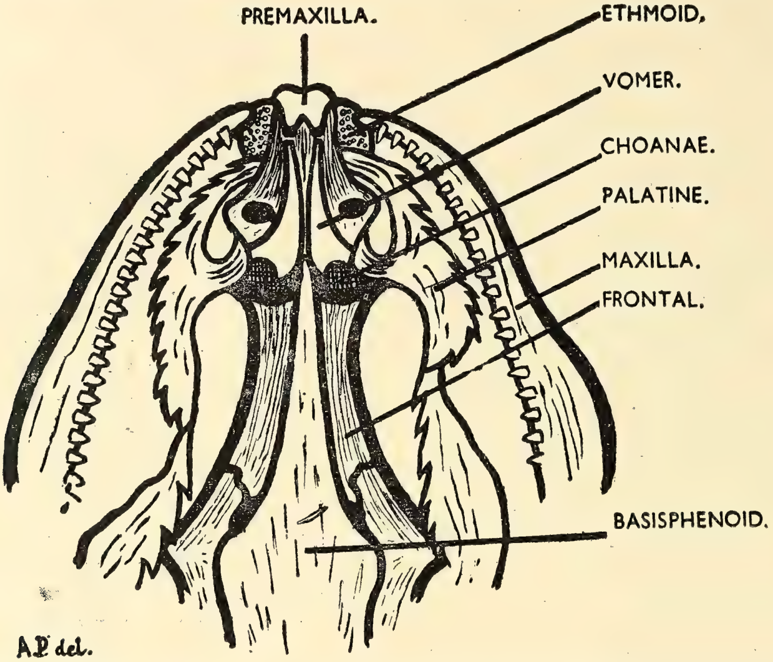

Fig. 1.—General idea of the anterior aspect (ventral) of a snake's skull showing the relationship of the vomer and choanae.

Anatomy of Bungarus caeruleus.

The general anatomy of the olfactory organ and its complimentary structures is not exceptional in the case of the Common Krait. An anterior palate, made up of thin tissue forming a sort of roof, is stretched across between the maxillae. Its length completes about one-third of the total tooth bearing maxillae and is rather short.

Leaving a space of about one-eighth of an inch above this, lies the roof of the mouth and the palate proper. Behind this tissue roof are the openings into the internal nares and the connections with the nostrils. (See plates.)

A note on nervous tissues.

Nerve tissue is made up of a series of cells which have the power of not only receiving but also interpreting stimuli. These cells are neurons and have a main body, a nucleus and radiating from the whole are many tails called dendrites with one particularly long dendrite known as the axon. It is along the axon that the nerve impulse passes. The axon eventually breaks up into tufts of many branches (terminal arborisation) and it is from here that the axon passes on the stimulus to either another cell or to fibres within the muscle, whence it is conveyed to the central nervous system. The axons sometimes become very long and come

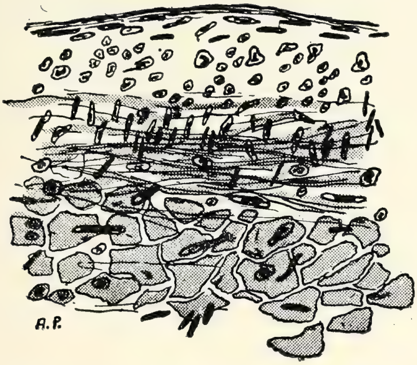

Fig. 1.—Longitudinal section through the tongue of *Bungarus caeruleus*. (Note absence of taste buds.)

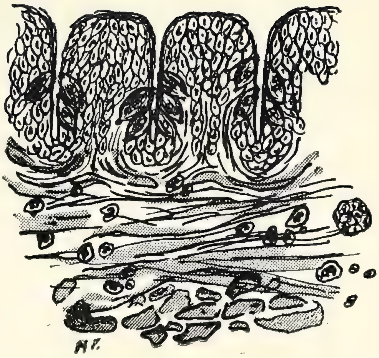

Fig. 2.—Longitudinal section through tongue of a rabbit showing taste buds in the epithelium.

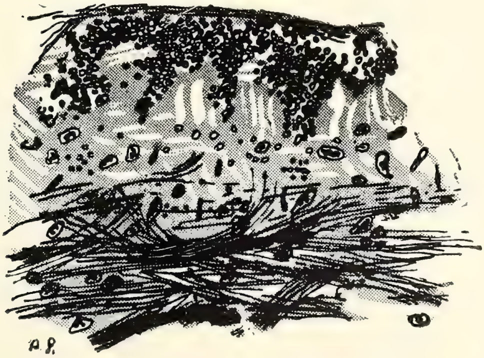

Fig. 3.—Portion of a longitudinal histological section of a piece of olfactory tissue from *Bungarus caeruleus* showing nerve fibres in section and bundles.

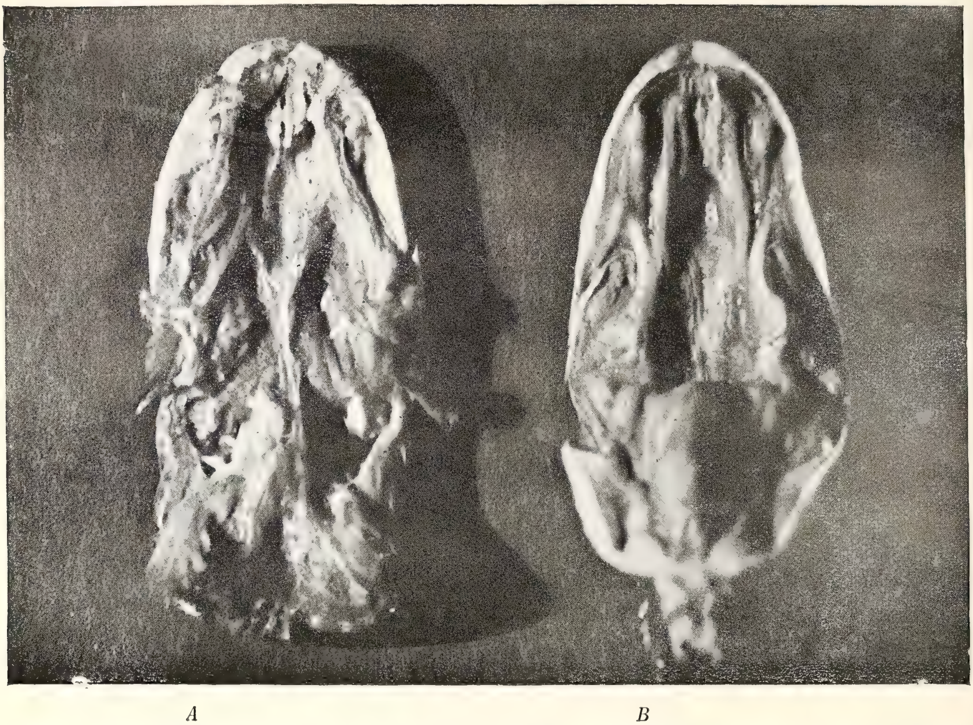

Fig. 1.—Photograph of the palate of the Common Krait (*Bungarus caeruleus*). *A*. Dissected. *B*. Natural. *See explanation below.*

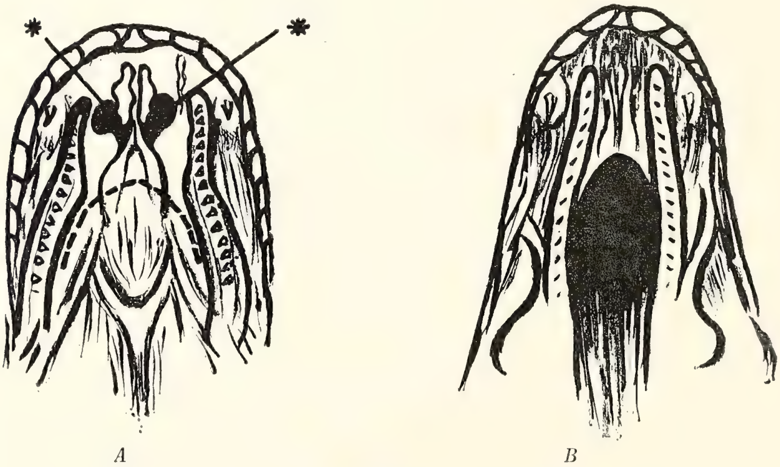

Fig. 2.—Diagram in explanation of the photograph above.
A.—This shows the palate after the removal of the arch of tissue covering the openings into the nares (dotted line shows the original position of it). The openings into the nares are marked *.
B.—The natural palate showing the arch and the cavernous appearance of the roof of the mouth going beneath it.

together to form nerve fibres of which some tissue is made up. Usually the sense cells in the epithelium have a supporter cell lying on either side of them.

Physiology.

When air containing odorous particles is drawn through the nostrils or the mouth into the olfactory chambers, the cells known as receptor cells (which are particularly irritable to certain stimuli and line the nasal chambers) react to these odorous particles and the stimulus is passed to the afferent fibres, that is to say, those which pass through the dorsal root or one of the sensory cranial nerves, from whence they conduct the particular stimulus to the central nervous system.

A sensation is thus recorded.

Histology.

Specimens were dissected from the heads of both the male and female kraits and these were histologically sectioned as thinly as was possible and stained with haematoxylin and eosin and the nervous tissue stains.

First of all the tongue was sectioned (see plate) and this was compared with that of a rabbit. There were no traces whatsoever of any taste buds in the tongues of the snakes to suggest a sense of taste in these creatures. The plate will readily show the taste buds in the section of the rabbit's tongue; they lie within the epithelial papillae.

The snake's tongue demonstrates a wealth of epithelial cells and some muscular tissue.

Next, the olfactory was sectioned and proved to be most interesting on examination. Both the olfactory lobe and a portion of the nasal tissue were examined.

Generally the surface showed evidence of cross-sectioned nerve bundles overlaying many small granule-like cells with a few nerve fibres running in between them.

Dotted about the entire centre of the organ were many large nerve cells and although the sections were rather thick it appeared that these large cells were held together by strand-like structures or fibrils which were no doubt made up from the cell dendrites. Beneath these large cells many bundles of nerve fibres were seen containing a medley of cells.

The organ as a whole appeared to be well endowed with nerve cells and fibres and suggested a quite highly developed and efficient working olfactory organ.

EXPERIMENT NO. 1.

Sensitivity Tests.

A box was prepared, having a glass front and being divided centrally into two chambers. The dividing piece had in one bottom corner an aperture 3 inches by 3 inches, over which was hung a piece of damp cloth to cover it.

For the purpose of the experiments the left-hand chamber is to be known as 'A' and the right 'B', The tests were carried out between about 8 p.m. and 8 a.m. In chamber 'A' a bowl containing slightly warmed concentrated Formaldehyde was placed and a male krait was also put in the same side. The vapour from the Formaldehyde did not appear to embarrass the snake for some time; the next morning, however, the krait had moved its abode by means of the aperture and was seen to be in chamber 'B' which was well ventilated. The experiment was repeated several times with males and females and most of them moved to the neighbouring chamber. Three died in chamber 'A', two being females.

I attribute the delay in any reaction to the fact that snakes appear to have the power of 'cutting off' their respiratory system on receipt of an unpleasant stimulus (Formaldehyde is more of an irritant than a bad smell) and also to the fact that the Formaldehyde vapour was of insufficient strength to more than irritate the nasal membrane in the first instance.

Similar experiments were carried out with other commodities and a table is appended to show the reactions.

Table showing the various reactions of Bungarus coeruleus to the given commodities.

Commodity	Snake	Sex.	Reaction
Formaldehyde	BUNGARUS COERULEUS.	5 ♂	4 from A to B. (1 died in A).
		5 ♀	2 from A to B. (2 died in A). (1 remained in A).
Decomposing vegetable matter...		4 ♂	Nil.
		4 ♀	Nil.
Petrol, Turpentine, Pyridine ...		4 ♂	2 from A to B.
		4 ♀	Nil.
		5 ♂	1 from A to B.
Fresh wild flowers ...		5 ♀	Nil.
Decomposed fly-blown krait covered with maggots ...		6 ♂	All to Chamber B.
		6 ♀	(Apparently to escape the maggots.)
Sulphur fumes		3 ♂	2 from A to B. (1 died in A.)
		3 ♀	1 from A to B. (2 died in A.)

There is no conclusive evidence that the movements were due to the snakes recording a bad stimulus by means of the olfactory organ but it is interesting to note that the males appeared more reactive than the females.

Samples of the commodities soaked into cotton wool and placed on the end of a stick were held over the nostrils of the snakes and the reactions were generally that the snake hid its head in its coils.

If the tongue actually touched the commodity the reaction was certainly more pronounced and rapid.

Experiment No. 2.

On February 4 two of my specimens were seen to be locked in coitus. The female was removed and the anal scent glands were carefully dissected. The dark black creamy substance therefrom was then removed and a line of it was streaked from 'A' to to 'B' through the aperture.

The male krait was placed in chamber 'A'. After about three hours he was seen to be in chamber 'B' exploring. This experiment was not repeated.

Whilst I do not believe that the anal gland has any significance sexually, as I do not perceive any macroscopical or histological change in it, and as insufficient data is available to prove that it is by this means that the male detects its mate,[1] I do feel that the krait was appreciative to the particularly pungent smell of the excretion from the glands.

Later, a corner of another box was smeared liberally with the same substance from the anal glands and be it by choice or coincidence, the entire kraits contained therein coiled themselves in that corner and if moved soon returned to the same spot.

Mr. S. H. Prater in his article 'The Social Life of Snakes' (*J.B.N.H.S.*, vol. xxxvi, p. 475) suggested that the function of the anal glands may be in the locating of the female by the male during the breeding or mating season; he adds that these problems require further elucidation.

Colonel Wall on the same subject writes: 'Anal Glands.—The anal or scent glands secrete a blackish material of the consistency of a soft ointment. This has a peculiar, rather disagreeable, but not very penetrating smell. The glands in the both sexes are active at all seasons, and at all stages from the time of hatching, so that I am inclined to question the popular belief fostered by Darwin (Descent of Man, p. 539) among others that they are concerned with the sexual functions.'

Conclusion.

From the anatomy of the palate and the olfactory organs it appears that there is a definite functional link between the two. The presence of the tissue stretched across between the palate and the mouth is suggestive of an attempt to collect odorous particles which enter the mouth by means of the tongue. The vapour therefrom would be conveyed through the narial openings to the internal nares lined with epithelium innervated by the olfactory.

In this connection the tongue undoubtedly plays an important role in being the method of transport of the odorous particles to the narial openings.

From the histology it would appear that the tongue has no appreciable sense of taste. Experimentally it is observed that although there is some reaction to certain commodities touched by the tongue, this reaction is due largely (that is, when the commodity was not an irritant) to the tongue conveying the particles of the commodity to the olfactory organ and thereby setting up a stimulus.

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[1] I have frequently dug for Kraits and found male and female paired during hibernation.

This method of the appreciation of smell in snakes is, I think, as well developed as the method of through the nostrils'.

I do not consider that the snake places its tongue over the nostrils in order to deposit odorous particles. I admit that particularly with the larger snakes and lizards too, the tongue becomes so unwieldly that on the tongue being withdrawn it tends to flap, thereby giving the impression that it is 'licking its nostrils'.

It appears, then, that the snake is endowed with a very efficient organ of smell and that this is used in all phases of its life.

The olfactory mechanism including the nostrils is reinforced by the action of the tongue, which may be considered as a secondary olfactory organ, inasmuch as it conveys the odorous particles through the mouth to the palatine narial openings. I suggest that the majority of the flicking in and out of the tongue is done with the object of collecting these odorous particles for identification by smell. In this way the snake may often be mistaken and this would account for its most extraordinary tastes at times.

I do not find that the belief that the tongue serves as a sweating apparatus to regulate the heat engendered in the body by muscular action, very tenable, as in the number of histological sections I have examined I do not perceive any trace of sweat apparatus nor do I see any relative tissue.

The findings of this short study tend to support the theory that snakes are by no means anosmic but they can and do differentiate very considerably between the various smells, and that they use this sense very largely during the process of their lives.

Appreciation.

My very grateful thanks are due to my friend Capt. (Miss) Margaret Hamilton, R.A.M.C., for her kind criticisms and assistance and also to Major C. Lyn Greening, I.M.S., Director of the District Laboratory, Lucknow, for allowing me all facilities, for the preparation of the histological sections and for his advice.

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EXPLANATION OF PLATES.

PLATE I.

Fig. 1.—Longitudinal section through the tongue of *Bungarus caeruleus.* (Note absence of taste buds.)

Fig. 2.—Longitudinal section through tongue of a rabbit showing taste buds in the epithelium.

Fig. 3.—Portion of a longitudinal histological section of a piece of olfactory tissue from *Bungarus caeruleus* showing nerve fibres in section and bundles,

PLATE II.

Fig. 1.—Photograph of the palate of snake (*Bungarus coeruleus*).
'A', Dissected. 'B', Natural.

Fig. 2.—Diagram in explanation of the photograph above.

A.—This shows the palate after the removal of the arch of tissue covering the openings into the nares. (Dotted line shows the original position of it.) The openings into the nares are marked *.

B.—The natural palate showing the arch and the cavernous appearance of the roof of the mouth going beneath it.

A GENERAL REVIEW OF THE MARINE ALGAE OF THE WESTERN COAST OF INDIA.

BY

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(*With 3 plates*)

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INTRODUCTION AND ACKNOWLEDGEMENT.

A paper entitled 'A note on the Algae collected by James A. Murray at Karachi' by Mr. S. C. Dixit, published in *Current Science*, Vol. 9, No. 1, pp. 27-28, 1940, prompted me to undertake searching for the old species of marine algae of the coasts of Bombay and Karachi. This search led to several important discoveries on the question of distribution of the marine species of the western coasts of India. It was also discovered that certain observations made by Mr. Dixit on Murray's collections needed modifications as dealt with in the first paper. The interest thus created urged the writer to undertake a survey of all the species of marine algae of the coast line of Bombay Presidency known up to the present time. The result of this survey is embodied in brief in the general review of my paper. Recent investigation by Dr. P. L. Anand, M.SC., PH.D., of the Punjab University, as reported in his contribution on 'Marine Algae from Karachi', Chlorophyceae, Pt. I, 1940 and Rhodophyceae, Pt. II, 1943, led to the discovery of a few new records and new species. These however have since been published. So far my examination of these species reveals their record from this part of the sea is not likely to alter materially my observations on the distribution of the marine algae of this part of India.

I express my indebtedness to Mr. Gopal Chandra Mitra, M.SC., for his valuable assistance in the preparation of this paper.

REVIEW OF PAST WORK AND COLLECTIONS OF INDIAN MARINE ALGAE.

Collection of Indian algae can be traced from as early a period as 1798. Records show that marine algae growing along the coastline of India were gathered about 60 years earlier than the period of Murray's collection at Karachi. Wallichian sheets of marine algae (Wall. Cat. Nos. 7481, 7482, 7483, 7484, 7485, 7486, 7487, 7490) from the Andaman Islands, Penang and Singapore were collected in 1822. These algal materials can be taken as the oldest specimens of marine algae collected and preserved in India for the last one hundred and twenty-three years. Therefore collection and study of marine algae of the Indian seas date from 1822 onwards. Dr. Alexander Braun and Dr. W. Hervey mentioned in 1826 about Belanger's and Wight's collection of Chara and sea-weeds. Belanger was an ardent admirer of the treasures of the Indian seas. In 1836, as Director of the Botanic Gardens in Pondicherry, he collected sea-weeds along the coasts of Cape Comorin and its neighbourhood in South India. James Forbes Royle, late of medical staff of the Bengal Army, published a short note on algae in his monumental work on the 'Illustrations of the Botany and other branches of the Natural History of the Himalayan Mountains and of the Flora of Cashmere' in Vol. 1, pp. 441-42, 1839, where Royle suggests that the *Dictyoteae* increase in numbers as we approach the equator; and *Hypnea, Cystoseria, Sargassum, Zonaria, Spharococcus, Thamneria, Acanthophora, Tamnophora, Amansia, Caulerpa* and *Gelidium*, of which swallows build the so much prized 'edible bird's nests' abound in tropical seas. Few have been described from the Indian Ocean, but several are contained in Dr. Rottler's Herbarium.' He also mentioned that 'A few species of Confervas' are found in Dr. Rottler's Herbarium from the neighbourhood of Tranquebar. Dr. W. H. Hervey described three charming sea plants in 1854 from the south coast of Ceylon under three genera. The three species mentioned by him are *Vanvoorstia spectabilis, Claudea multifida* and *Martensia spectabilis*. The genus *Vanvoorstia* was named after the reputed naturalist John Van Voorst, author of the Natural History of Great Britain. This genus was established for the first time by Dr. Hervey. Reports on the marine algae of Ceylon—Ecological and Systematic studies of the Ceylon species of Caulerpa by Dr. Nils Svedelius of Upsala published in the Biological Results of the Ceylon Fishery, 1905, is a valuable contribution towards our knowledge of marine flora of India and Ceylon. The original set of Hervey's collection of Ceylon algae is preserved in Trinity College, Dublin. The duplicates are available for study at the Royal Rik's Museum in Stockholm and in J. G. Agardh's Herbarium in Lund. A few stray sheets are in the Calcutta Herbarium mixed up with Fergusson's specimens. (1) The earliest collector of sea-weeds of Karachi is not J. A. Murray but Vice-Admiral W. J. S. Pullen who gathered some interesting specimens of marine algae from Karachi proper in 1859-60. A large number of valuable well-preserved old sheets of Wallich (1822), Hervey (1853), Anderson (1861), Kurz (1867), Fergusson (1875), J. A. Murray (1881), King and Prain (1889-90), Heinig (1896), Gardiner (1899) and others are in the Calcutta Herbarium under the safe custody of Government. Prof. Borgesen visited India at the invitation of the Bombay University and during his stay in this country from the middle of December 1927 to the end of January 1928 made a fair collection of algae from the Bombay coast with the help of Messrs. S. C. Dixit, G. Ayengar and K. G. Naik. These were subsequently worked out by Prof. Borgesen in Copenhagen and the result published mostly in the Journal of the Indian Botanical Society and Kew Bulletin. I am not aware if the original set of this collection is in the Bombay University or elsewhere in India. If not, steps should be taken to obtain for India the original or at least the duplicate set of this collection including the type or cotype sheets of the new and unrecorded species discovered in this collection.

A set of 39 excellent Herbarium sheets of Murray's original algal specimens from Karachi collected in 1881-83 and preserved at the Herbarium of the Royal Botanic Garden, Calcutta, proves that Mr. Dixit's inference that 'it is a loss to science that Murray's first collection is not preserved in the country' as mentioned in his note on the algae collected by James A. Murray at Karachi, in *Current Science*, Vol. 9, No. 1, pp. 27-28, January 1940, is also not based on sufficient authentic information. Any algologist dealing with sea algae cannot but doubt the accuracy of the determination of algae mentioned in Murray's book on 'The Plants and Drugs of Sind'. In this book under class I, Thallogens Alliance 1. Algalis Murray records under 3 Natural orders 22 species representing 14 genera. It is expected that if these algae were correctly identified at least some of the species would have been mentioned in Prof. Borgesen's works which were based on Murray's Karachi algae located in the Kew Herbarium and the Herbarium of the British Museum (Natural History), London. There would also have been some of Murray's species represented among the Calcutta set of his Karachi algae, 25 per cent of which are found among the Herbarium materials at Kew. The Calcutta Herbarium possesses a set of well-preserved sheets of Murray's algae which were sent to the late Sir George King some time in 1884 or thereabout evidently for naming. Of these excepting six species which are both in Kew and in Calcutta collections the rest of the Karachi specimens of Murray at the Calcutta Herbarium do not seem to have been reported so far. Examination of Murray's list of algal specimens reveals that there is much confusion in the nomenclature too. Out of 22 species noted in Murray's book only one species, *Ceramium rubrum* (*Huds.*) Ag. var. *virgata* Ag., is reported by Borgesen with the remark that 'two well-preserved specimens of this form of *Ceramium rubrum* widely spread in the Arctic Sea and in the northern Atlantic Ocean are present in the collection of Algae belonging to the Kew Herbarium. Their occurrence in the Arabian Sea is therefore rather astonishing'—Kew Bull., No. 1, p. 19, 1934. This species Borgesen reported again in his exhaustive paper on Karachi algae entitled 'Some Marine Algae from the Northern Part of the Arabian Sea with remarks on their geographical distribution' (published in Det. Kgl. Dansk. Viden. Sel. Biolog. Medd. Vol. xi, No. 6, p. 41, 1934) with locality 'India, Karachi'. He however omitted this species in his subsequent paper on 'A list of Marine Algae from Bombay' (published in Ibid., Vol. xii, No. 2, 1935) as he was then definitely doubtful about the occurrence of some of the northern species which were incorporated in his previous lists by mistake and he explained this fact in his footnote to the paper. Further it cannot be imagined how the northern temperate species of *Laminaria saccharina* (L.) Lam. was found by Murray in Karachi. The family Laminariceae is confined entirely to the north temperate regions. It is equally puzzling to account for the range of distribution of the species *Laminaria saccharina* as noted by Murray in his book 'from the Caspian into India. In the Thibet it is said by Honigberger (a medical man) to grow in Salt Lake'. This species is distributed in the northern part of the Atlantic and the Pacific Ocean. From the above facts it becomes clear that Kirtikar and Basu are not far wrong in doubting the specific determination of the plants catalogued by Murray. They in their work on Indian Medicinal Plants, Pt. I, p. xiii, para 3, 1918 (Introduction) remark that 'Murray neither being a medical man nor a skilled botanist compiled his work from other sources and, as such, the work is of doubtful value'. The literature and the authorities consulted by Murray leads any botanist to the same conclusion. Moreover, the range of distribution of many of Murray's sea algae hitherto recorded in standard works shows that it is extremely unlikely that some of his northern species as noted in his contribution can possibly find their abode in Karachi. Prof. Borgesen therefore in the concluding sentence to his discussion on the geographical distribution of the algae of the northern Arabian Sea remarks that 'it would be of great interest to confirm the presence of the above mentioned northern species found there by James A. Murray according to his collection in the Kew Herbarium'. Extracts quoted above by Mr. Dixit from Borgesen's paper in support of his argument is therefore rather misleading. The full paragraph relating to the point is as follows:—

'But the most important result of the examination of the collection of the British Museum was to establish that none of the northern and arctic algae mentioned in my list were found in the collection. When I heard that the British Museum also possessed a large collection of J. A. Murray's Algae from Karachi I was of course especially interested in finding out whether the northern species were found there too. This not being the case greatly increases my doubts as to whether they really live there, and seems to me to render it probable that they have come into Murray's collection found in the Kew Herbarium by mistake.' The specimens of James A. Murray as noted in his book are not likely to be lost to science but the confusion is due to their wrong identification. This explains the reason why the specimens mentioned by Murray are absent in the collections of his Karachi algae at Kew, British Museum and Calcutta Herbarium. Consequently the species as named in Murray's book are also not found in Borgesen's works on Karachi algae including Murray's original materials. Thus it follows that the original collection of Murray is not only at the Kew and British Museum but also in the Calcutta Herbarium evidently under different names. These algae have already been worked out by Prof. Borgesen. Mr. Dixit therefore need not burden under the misapprehension that James A. Murray's collection of marine algae from Karachi is lost to science. It will also be obvious from the points discussed above that Prof. Borgesen simply asserts that some of the specimens of northern arctic algae, referred to in his paper on the Marine Algae from northern part of the Arabian Sea, found their access into J. A. Murray's collection at Kew Herbarium through mistake. These specimens wrongly placed with Murray's collection set Borgesen to speculate on the migration of some of the northern temperate species in tropical seas and to draw certain rather far-fetched conclusions while dealing with the geographical distribution of the marine algae on the northern part of the Arabian Sea. Some of Borgesen's arguments advanced to account for the occurrence of these northern specimens cannot be supported by previous data which established the dominating influence of Malayan and Australasian elements in the distribution of deep water and littoral algae in the tropical waters of the Indian Ocean. Borgesen's footnote, quoted above, to his paper on 'A list of marine algae from Bombay' where he points out his mistakes detected during his scrutiny of Murray's set of algae at British Museum (Natural History), London, is of greatest importance to oceano- and phyto-geographers and those interested in the distribution of sea-weeds. Some of his views expressed under the heading 'Some Plant Geographical Considerations' demand revision in the light of the distribution of species contained in the additional collection of James A. Murray's algae at the Calcutta Herbarium which he does not seem to have examined in dealing with the Bombay algae.

It will be obvious from the statement above 'how a wrong statement made by Borgesen led to misleading speculation about the geographical distribution of the flora and fauna in this part of the Indian sea. Sewell states, 'It has recently been discovered that a very high percentage of species of Marine Algae are common to the Indian Ocean and the North Atlantic Ocean, some even occurring in the Arctic region.' ('The oceans round India' by R. B. S. Sewell, p. 40, An outline of the Field Sciences of India, 1937). This statement is evidently based on Borgesen's observation on the geographical distribution of the algae of the northern Arabian Sea after Borgesen's comparison of Murray's sheets at Kew. 'It would be of great interest,' Borgesen however remarked, 'to confirm the presence of the above-mentioned northern species found there by James A. Murray according to his collection in the Kew Herbarium.'

DISTRIBUTION OF MARINE ALGAE OF THE BOMBAY COAST LINE.

The total number of species and varieties known to us from the western coast of India is 255, representing 5 species of Myxophyceae, 81 of *Chlorophyceae,* 38 of *Phaeophyceae* and 131 of Florideae. Endemic species, varieties and forms are only 45, thus representing only 17 per cent of the algae recorded from this area of the seashore of the Peninsular India. South-Western Australia has many species common to the Malayan Archipelago. Hence from the point of view of algal distribution the part of the water bordering the south-western coast of Australia may very well be considered botanically as a part of the Malayan Archipelago. The south-eastern element therefore becomes predominant in the algae of the western coasts of India as this element represents approximately 50 per cent of the Malayan and South-West Australian species, while the Atlantic or north-western element including Europe, Africa and the Mediterranean element is about 33 per cent.

Some of the Malayan species evidently migrated to the Arabian Sea from the Pacific and the Indian Oceans with the oceanic currents and ships calling at the port of Bombay. Climatic and biotic factors might have thus influenced the passage of many overseas western and eastern species into the Arabian Sea and their subsequent acclimatisation along the coastline of Bombay and Sind. The inference is based on the analysis of the species as illustrated in detail in the following table showing regional distribution of the species:—

The table shows the regional distribution and percentage of the different species recorded from the Bombay Coast.

	Bombay coast	Percentage
West Indies and America (Atlantic coast) ...	101	39·6
Europe and Africa (Atlantic coast)	99	38·8
Mediterranean	77	30·2
Cape	36	14·1
Red Sea	70	27·4
Malayan Archipelago	103	40 3
S. W. Australia	73	28·6
Japan	80	31·3
N. E. Australia	38	14·9
Polynesia	70	27·4
America (Pacific coast)	52	20·3
Total number of species, varieties and forms recorded	255	...
Endemic species, varieties and forms	45	17·6

The census reveals, as already indicated by previous physiologists, that the Malaysian element is more dominant than the Atlantic. The difference however is not very great. This may be due to the geographical position of Bombay and Sind in the Eastern portion of the Arabian Sea. It remains however to be investigated how many of the species actually occur along the Bombay Coast and how many are migratory which simply float down to the Arabian Sea.

The question of the distribution of marine algae is more complicated than that of the higher plants. The problem of distribution of the Indian marine algae is dependent on ecological factors, physical and chemical nature of the water, hydrographical and biological conditions in the Indian seas, geological history of the land masses and periodicity and auto-ecology of the different species of algae representing the marine flora of the area under investigation. Our knowledge of the Indian Sea algae belonging to all the groups is far from complete, although some valuable works by distinguished physiologists exist. It is too early to draw any definite conclusion on the distribution of our marine flora.

A detailed field investigation and a careful study on the different aspects of the marine algae including *Diatomales* ranging for at least three different seasons are likely to throw light on many important questions such as distribution, nature of the growth and yearly production of the economic species. These data are of considerable value not only to science but also to the important question of utilising the marine vegetation of the Indian Coast line for commercial, agricultural and industrial purposes.

In order to have an approximate estimate of the marine flora of the Indian coastline extending over nearly 5,000 miles and the islands in the Indian Ocean, it is imperative that a systematic physiological survey on proper scientific lines should first of all be undertaken without further delay. Such a survey will form the basis of all subsequent studies. When the survey work is completed a detailed investigation should then be carried on by a set of scientists and industrialists in order to devise ways and means for utilising the useful species of sea-weeds and other marine flora in a suitable manner. The importance, therefore, of gathering necessary information on the Indian marine flora need not be emphasised.

Chart showing the range of distribution of the recorded species from Bombay seaside in different parts of the world:—

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Myxophyceae												
Micorcoleus chthonoplastes (Fl. Dan) Thuret		+	+			+						
Sirocoleus kurzii (Zell) Gom.		+	+			+						
Lyngbya majuscula Harv.	+	+	+		+	+	+	+	+	+	+	+
Lyngbya confervoides C. Ag.	+	+	+		+	+	+	+	+	+	+	+
Lyngbya infixa Fremy	+	+	+			+						
Chlorophyceae												
Enteromorpha compressa (Linn) Grev. var. typica forma campanulata Chapman ...						+						
Enteromorpha flexuosa (Wulf) J. Ag. ...	+	+	+	+	+	+	+	+			+	+
Enteromorpha intestinalis Kuetz. var. cornucopiae Kuetz.		+				+						
Enteromorpha tubulosa Kuetz.		+	+			+	+	+	+	+	+	+
Enteromorpha intestinalis Kuetz. forma tubulosa Chapman			+									

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Enteromorpha prolifera (Muell.) J. Ag. ...	+	+	+			+	+	+	+	+	+	+
Enteromorpha prolifera Ag. forma capillaris Chapman						+						+
Enteromorpha minima Naeg.		+	+			+					+	
Ulva lactuca (L.) Le Jolis	+	+	+		+	+	+		+		+	+
Ulva reticulata Forsk			+		+	+				+		
Ulva indica sp. nov. Anand						+						
Ulva fasciata Delile	+	+	+		+	+	+					+
Ulva fasciata Delile forma taeniata Setch ...						+						
Endoderma leptochaete Huber		+				+						
Endoderma viride (Reinke) Lagerheim ...	+	+	+			+	+				+	+
Endoderma Wittrockill (Wille) Lagerh. ...		+				+						
Valonia aegagrophila C. Ag.	+	+	+		+	+	+		+		+	
Valonia utricularis (Roth) Ag.	+	+	+		+	+	+				+	
Entocladia polysiphonia sp. nov. Anand ..						+						
Cladophoropsis sundanensis Reinbold ...						+	+					
Cladophoropsis Zollengeri (Kuetz.) Boergs. ..						+	+					
Pseuduevella sp.						+						
Boodlea composita (Harv. et Hook. fil) Brand		+				+	+					
Valoniopsis pachynema (Mart.) Boergs. ...	+					+	+			+	+	
Willelia ordinata Boergs						+						
Chaetomorpha prostrata sp. nov. Anand ...						+						
Chaetomorpha media (Ag.) Kuetz. ...	+					+	+	+	+		+	+
Chaetomorpha torta (Farlow) McClatchie ...						+			+			+
Chaetomorpha Linum (Muell) Kuetz. ...	+	+	+	+	+	+	+		+		+	+
Chaetomorpha indica Kuetz.					+	+						+
Chaetomorpha aerea (Dilw.) Kuetz. ...	+	+	+	+	+	+	+	+	+	+	+	+
Chaetomorpha clavata (Ag.) Kuetz. ...	+			+	+	+			+			+
Lola (?) capillaris (Kuetz.) A. et G. Hamel ...		+	+			+						
Rhizoclonium kochianum Kuetz.	+	+				+						
Rhizoclonium tortuosum Kuetz.		+	+			+						+
Rhizoclonium implexum (Dilw.) Kuetz. ...	+	+				+						+
Rhizoclonium grande Boergs.						+						+
Rhizoclonium Kerneri Stockm.	+					+						+
Cladophora colabense Boergs.						+						
Cladophora Fritschii Sp. nov. Anand ...						+						
Cladophora Fritschii Anand var. nov. Kemariensis Anand						+						
Cladophora saracenia Boergs.						+						
Cladophora fascicularis (Mart) Kuetz. ...	+				+	+						
Cladophora bombayensis Boergs.						+						
Cladophora Magdalene Harv.		+				+						
Cladophora monumentalis Boergs. ...						+						
Cladophora (Hutchinsiae ?) (Dilw.) Kuetz. ...	+	+	+			+						
Struvea delicatula Kutz	+	+	+			+		+				+
Chamaedoris auriculata Boergs.						+						
Acetabularia Mobii Sokms-Labauch ...						+			+			

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Acetabularia caliculus Quoi et Gaimard ...	+					+		+	+			
Bryopsis corymbosa J. Ag.			+			+						
Bryopsis Plumosa (Hud.) Ag.	+	+	+	+		+	+	+	+		+	+
Bryopsis pennata Lamour. var. minor J. Ag....						+						+
Bryopsis hypnoides Lamour	+	+				+		+	+			
Pseudobryopsis mucronata Boergs... ...						+					+	
Codium coronatum Setch						+						+
Codium tomentosum (Huds.) Stackh ...	+	+	+	+	+	+	+	+	+		+	+
Codium latum Sur	+					+			+			+
Codium elongatum Ag.	+		+	+		+		+	+			
Udotea indica A and E. S. Gepp.						+	+					
Siphonocladus sp.						+						
Halimeda Tuna (Ell. et. Sol.) Lamour ...	+	+	+	+	+	+	+		+	+	+	
Caulerpa taxifolia (Vahl.) Ag. ...	+	+			+	+	+		+	+	+	
Caulerpa scalpelliformis (R. Br.) Web. v. Boss		+			+	+	+	+	+	+		
f. intermedia Web. v. B.						+	+					
f. dwarkensis Boergs.						+						
Caulerpa sedoides (R. Br.) Ag.	+					+		+				
Caulerpa fastigiata Mont	+					+					+	
Caulerpa sertularioides (Gmel.) Howe ...	+	+			+	+	+	+	+	+	+	+
Caulerpa racemosa (Forsk) Webb. v. Boss. var. clavifera (Turn) Webb. v. Boss. ...	+	+	+	+	+	+	+	+	+	+	+	
f. typica Boergs						+						
var uvivera (Turn) Web. v. Boss. ...												
f. condesata (Kuetz) Web. v. Boss. ...						+	+					
var laetevirens (Mont) Web. v. Boss. ...												
f. typica Web v. Boss.						+	+					
f. laxa (Grev.) Web v. Boss.						+						
var corynephora (Mon) W. v. B. ...	+					+	+	+			+	
Caulerpa peltata Lamour	+				+	+				+	+	
Vaucheria piloboloides Thur.		+	+			+						
Ostreobium Reineckei Bornet.	+					+	+					+
Phaeophyceae												
Ectocarpus coniger Boergs.						+						
Ectocarpus Cylindricus Sanuders												
Ectocarpus Mitchellae Harv.	+	+				+						+
Myriogloea sciurrs (Harv.) Kuck. ...				+		+				+		
Gonodia arabica (Kuetz.) Boergs. n. Comb. ...		+				+						
Nemacystus decipiens (Suhr.) Kuck. ...						+			+			
Rosenvingea intricata (J. Ag.) Boergs. ...	+	+				+	+				+	
Rosenvingea orientalis (J. Ag.) Boergs. ...	+					+	+				+	
Colpomenia Sinuosa (Roth.) Derb. et. Sol. ...	+	+	+	+	+	+	+	+	+	+	+	+
Colpomenia Stellata (Boergs.) Boergs. ...						+						
Hydroclathus cancellatus Bory	+	+		+	+	+	+	+	+	+	+	+
Sphacelaria tribuloides Menegh.	+	+	+	+	+	+	+	+				

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Sphacelaria furcigera Kuetz.	+	+	+	+	+	+	+	+	+	+	+	+
Spathoglossum asperum J. Ag.						+	+					
Spathoglossum variabile Fig. et. De. Not. ...					+	+	+					
Stoechospermum marginatum (Ag.) Kuetz. ...					+	+						
Stoechospermum patens Hering					+	+						
Stoechospermum ? maculatum J. Ag. ...						+						
Zonaria variegata (Lamour.) Ag. ...	+	+			+	+	+			+	+	
Padina tetrastromatica Hauck	+					+	+					
Padina Fraseri (Grev.) J. Ag.						+		+				
Padina Commersonii Bory	+				+	+	+	+	+	+	+	
Phyllaria reniformis (Lamour) Rostaf ...		+	+			+						
Dictyopteris acrostichoides J. Ag. ...						+		+				
Dictyopteris australis Sond						+		+		+		
Dictyota Bartayresiana Lamour	+	+			+	+	+	+				
Dictyota dumosa Boergs.						+						
Dictyota maxima Zanard						+	+					
Dictyota Atomaria Hauck	+					+						
Dictyota pinnatifida Kuetz.	+	+				+	+					
Dictyota acuminata Kuetz.		+	+		+	+	+					
Dilopus Fasciola (Roth) Howe	+		+		+	+	+					
Cystophyllum muricatum (Turn.) J. Ag. ...						+	+	+		+	+	
var. virgata (Endl. et. Diew) J. Ag. ...						+	+	+				
Sargassum tenerrimum J. Ag. ...						+						
Sargassum persicum kuetz.					+	+						
Sargassum illicifolium (Turn.) C. Ag. ...	+				+	+	+					
Sargassum cinereum J. Ag.						+	+					
var. berberifolium Grum.						+	+					
Sargassum plagiophyllum (Mert.) J. Ag. ...						+	+	+				
Rhodophyceae												
Erythrotrichia carnea J. Ag.	+	+	+			+	+					+
Goniotrichum elegans (Chauv.) Le Jolis ...	+	+	+		+	+	+		+	+	+	+
Erythrocladia subintegra Rosenvingea ...	+	+			+	+	+					+
Acrochaetium crassipes Boergs.	+	+				+			+			
Acrochaetium erectum Boergs.						+						
Acrochaetium sargassicolum Beorgs. ...						+						
Acrochaetium dwarkense Boergs.						+						
Liagora ceranoides Lamour	+	+			+	+	+	+	+			
Heliminthocladia australis Harv.						+		+	+			
Chrysymenia Uvaria (L.) J. Ag.	+	+	+			+		+	+			
Scinaia Hatei Boergs....						+						
Scinaia indica Boergs.						+						
Scinaia furcellata J. Ag.		+	+			+		+	+			
Gloeophlea fascicularis Boergs.						+						
Golaxaura oblongata Lamour	+	+	+		+	+	+		+			
Asparagopsis sandfordiana Harv.						+		+	+			
Gelidium pusillum (Stackh) Le Jolis ...	+	+	+		+	+	+	+	+	+	+	+

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Geidium pulvinatum (Kutz.) Thur.		+				+						
f. parvissima Boergs.												
Gelidium heleroplator Boergs.						+						
Gelidium corneum (Huds.) Lamour	+	+	+	+	+	+	+	+	+	+	+	+
Gelidiopsis variabilis (Grev.) Schmitz	+	+			+	+	+		+	+		
Gelidiella myrioclada (Boergs.) Feldm. et Hamel						+						
Echinocaulon acerosum (Forsk.) Boergs.	+	+	+		+	+	+		+		+	
Caulacanthus ustulatus (Mert.) Kuetz.		+	+	+		+	+					
Chondrococcus Hornemanil (Mert.) Schmitz.				+	+	+	+	+	+		+	+
Peyssonnelia obscura Web. v. Bosse						+						
var. bomabyensis Boergs.												
Crouriella bicolor Boergs.						+						
Hildenbrandia prototypus Nardo.	+	+	+	+	+	+	+	+	+	+	+	+
Amphiroa fragilissima (L.) Lamour	+	+	+			+	+		+		+	+
Amphiroa anceps (Lamour.) Decsne	+			+		+	+	+			+	+
Amphiroa dilatata Lamour				+		+			+	+		+
Cheilosporum spectabile Harv.						+	+				+	
Corallina officinalis Linn.	+	+	+	+		+			+	+	+	+
Jania rubens (L.) Lamour	+	+	+	+	+	+	+		+		+	
Grateloupia indica Boergs.						+						
Grateloupia filicina (Wulf.) Ag.	+	+	+	+		+	+		+	+	+	+
Halymenia fastigiata J. Ag.			+			+						
Halymenia porphyroides Boergs.				+		+						
Halymenia polydactyla Boergs						+						
Halymenia venusta Boergs.						+						
Cryptonemia undulata Sond						+		+				
Cryptonemia Lomation (Bertel.) J. Ag.		+	+			+	+					
Solieria robusta (Grev.) Kylin						+	+	+	+			
Sarconema scinaioides Boergs.						+						
Sarconema furcatum Boergs.						+						
Sarconema furcellatum Zanard					+	+						
Sarconema filiforms (Sond.) Kylin						+		+				
Sarconema miniata (Ag.) J. Ag.	+	+				+						
Meristotheca populosa (Mont.) J. Ag.					+	+	+		+		+	
Catenella repens (Lightf.) Batters	+	+	+			+					+	
Cystoclonium purpureum (Huds.) Batters	+	+				+						
Calliblepharis fimbriata Kutz.			+			+						
Hypnea Valentiae (Turn.) Mont.	+		+		+	+	+		+		+	
Hypnea musciformis (Wulf.) Lamour	+	+	+	+	+	+	+	+	+		+	+
Hypnea specifera (Suhr.) Harv				+		+						
Hypnea hamulosa J. Ag.	+			+	+	+	+			+	+	
Plocamium coccineum (Huds.) Lyngb.	+	+	+	+		+		+	+		+	+
Plocamium Telfairiae Harv.						+		+	+	+		
Sarcodia dichotoma Boergs						+						
Gracilaria foliefera (Forsk.) Boergs	+	+	+	+	+	+	+		+		+	
Gracilaria corticata J. Ag.					+	+	+		+			
var. ramalinoides J. Ag.					+	+						

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Gracilaria confervoides (L.) Grev.	+	+	+	+		+	+	+	+	+	+	+
Gracilaria arcuata Zanard	+		+		+	+	+		+		+	
Corallopsis Cacalia J. Ag.					+	+	+		+		+	
Gigartina acicularis (Wuld.) Lamour	+	+	+			+		+	+			
Ahnfeltia plicata (Huds.) Fr.	+	+				+			+			+
Callymenia reniformis (Turn.) J. Ag.	+	+				+						
Rhodymenia australis (Sond.) Harv.						+	+	+				
Halichrysis ? strafforellii (Ardiss.) De Toni			+			+						
Botryocladia leptopoda (J. Ag.) Kylin						+			+	+		
Dicranema ? furcellatum (Mont.) J. Ag.					+	+						
Coelarthrum Muelleri (Sond.) Boergs.						+		+	+			
Champia compressa Harv.				+		+	+	+	+		+	
Champia indica Boergs.						+						
Champia somalensis Hauck						+	+					
Champia parvula (Ag.) Harv.	+	+	+			+	+	+	+		+	
Erythrocolonium Muelleri Sond						+		+				
Ceramium rubrum (Huds.) Ag.	+	+				+						
var. virgata Ag												
Ceramium miniatum Suhr						+		+	+			+
Monospora indica Boergs.						+						
Spyridia filamentosa (Wulf.) Harv.	+	+	+		+	+	+		+	+	+	
Spyridia alternans Boergs.					+	+						
Spyridia aculeata (Schimp.) Kuetz.	+	+	+		+	+			+			
var. inermis Boergs.	+	+	+		+	+						
Centroceras clavatum (Ag.) Mont.	+	+	+	+	+	+	+	+	+	+	+	+
Haloplegma Duperreyi Mont.	+	+		+		+	+	+			+	
Griffithsia tenuis C. Ag.	+	+	+			+		+	+		+	
Griffithsia flabelliformis Harv. (?)						+		+			+	
Hypoglossum spathulatum (Kuetz. ?) J. Ag.						+	+	+		+		
Membranoptera Murrayi Boergs.						+						
Myriogramme okhanensis Boergs.						+						
Caloglossa bombayensis Boergs.						+						
Caloglossa Leprieurii (Mont.) J. Ag.	+	+				+	+		+	+	+	+
Nitophyllum punctatum (Stackh.) Grev.	+	+	+			+						
Platysiphonia miniata (Ag.) Boergs.		+		+		+						
Cottoniella fusiformis Boergs.		+				+						
Claudea elegans Lamour		+				+	+	+				
Laurencia papillosa (Forsk.) Grev.	+	+	+	+	+	+	+		+	+	+	
Laurencia obtusa (Huds.) Lamour	+	+	+	+	+	+	+		+		+	
var. divaricata (J. Ag.) Yam					+	+						
var. majuscula Harv.						+						
Laurencia cruciata Harv.						+		+	+			
Laurencia pannosa Zand						+		+				
Laurencia virgata J. Ag					+	+	+					
Laurencia hypnoides Boergs.				+		+					+	+
Laurencia filiformis (Ag.) Mont					+	+						
Laurencia platyclada Boergs.						+		+				
Laurencia pedicularioides Boergs.						+						

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan, Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Chondria dasyphylla (Woodw.) Ag. ...	+	+	+		+	+	+	+	+		+	
var. stellata Boergs						+						
Chondria cornuta Boergs.						+						
Chondria tenuissima	+	+	+			+	+	+	+		+	
Aacnthophora Delilei Lamour			+		+	+	+					
Acanthophora dendroideas Harv.						+	+	+				
Polysiphonia platycarpa Boergs.						+						
Polysiphonia variegata (C. Ag.) Zanard ...	+		+			+						
Polysiphonia ferulacea Suhr	+	+				+	+	+	+		+	
Polysiphonia elongata (Huds.) Harv. ...	+	+	+			+						
Polysiphonia utricularis Zanard					+	+						
Polysiphonia corymbosa J. Ag.						+						
Roschera glomerulata (C. Ag.)						+	+	+	+	+		
Lophocladia Lallemandi (Mont.) Schmitz ...	+		+		+	+	+	+	+			
Spirocladia Barodensis Boergs.						+						
Herposiphonia tenella (Ag.) Naegl. ...	+	+	+			+	+					
Leveillea jungermannioides (Mart. et Her.) Harv.						+	+	+	+	+		+
Heterosiphonia cloiphylla (Ag.) Falkb. ...				+		+						
Heterosiphonia Muelleri (Sond.) DeToni ...						+	+	+				
Heterosiphonia Wyrdemanni (Baill.) Falkb ... f. laxa Boergs.	+	+	+			+	+					
Dasya flagellifera Boergs.						+						
Falkenbergia rufolanosa (Harv.) Schmitz ...						+	+	+	+			+

Systematic enumeration of unrecorded and little known species in James Murray's Collection of Sea-weeds from Karachi (Bombay Coast) in the Herbarium of the Royal Botanic Garden, Calcutta.

CLASS—CHLOROPHYCEAE.

FAMILY I. ULVACEAE.

1. **Ulva fasciata** Delile. forma typica. De Toni Syllg. Alg., Chlo., vol. i, pp. 114-15. (Plate I, fig. 1.)

Thallus green or slightly yellowish green, 25-30 cm. long and 22-25 cm. broad; fronds fasciated, shortly stalked at the base, rather cuneate; segments opposite, simple or dichotomous, long, linear or linear lanceolate, gradually attenuated towards the apices, sometimes divided upwards, irregularly tortuous, sinuate and sparsely toothed along the margin, apex acute or obtuse; cells of the frond more or less verticillate, elongate, somewhat less elongated when converging tangentially towards the margin, rounded or angular in surface view, about 10 μ in diameter, oblong or rectangular as seen in the cross section of the upper part of the frond but much narrowly rectangular, nearly oblong or linear towards the base, about 16-20 μ long and 10 μ broad. Reported for the first time from the Bombay Coast.

Habitat.—Manora rocks, 'Kurachee', No. 11, Leg. J. A. Murray! 1881. Pl. I, fig. 1, 1/5 Nat. size.

This form of *Ulva fasciata* agrees well with the characters of the typical form of *U. fasciata,* forma typica, hence it has been accepted as such. It differs however in some points from the form described as *U. fasciata* by Anand in his 'Marine Algae from Karachi', Part I, Chlorophyceae, p. 16, 1940.

CLASS—RHODOPHYCEAE (FLORIDEAE).

FAMILY II. CHAETANGIACEAE.

2. **Scinaia furcellata** (Turn) Bivona. De Toni Syllg. Alg., Florideae, vol. i, pp. 104-5. (Plate I, fig. 2.)

Thallus fastigiate, one to many growing together, 5-25 cm. long and 10-15 cm. broad, brownish red or pale pink; fronds 2-15 cm. long, 1-2 mm. thick, cylindrical or sub-compressed, sometimes constricted at intervals, gelatinously membranaceous, somewhat tapering towards the base, repeatedly and regularly dichotomous and fastigiate; apices optuse or occasionally prolonged to subacute ends. Fruits not seen. Reported for the first time from the Bombay Coast.

Habitat.—On rocks, 'Kurachee', No. 44, Leg. J. A. Murray! 1881. Pl. I, fig. 2, 1/7 Nat. size.

FAMILY III. DICRANEMACEAE.

3. **Dicranema furcellatum** (Mont.) J. Ag. De Toni Syllg. Alg., Florideae, vol. i, pp. 271-72. (Plate I, fig. 3.)

Thallus solitary or more than one, rather furcate upwards, 10-20 cm. long and 8-15 cm. broad; fronds 5.1 mm. thick, slender filiform, cartilaginous-gelatinose, sparsely dichotomously branched, more or less fastigiate, branches often erecto-patent. Fruits not seen. Reported for the first time from the Bombay Coast.

Habitat.—Attached to rocks, 'Kurachee', Nos. 53, 54, 55, Leg. J. A. Murray! 1881. Pl. I, fig. 3, 1/6 Nat. size.

FAMILY IV. CALLYMINIACEAE.

4. **Callymenia reniformis** (Turn.) J. Ag. De Toni Syllg. Alg., Florideae, vol. i, pp. 297-98. (Plate I, fig. 4.)

Thallus 5-8 cm. in diameter, pinkish or flesh coloured; fronds about 10 cm. wide, membranous, gelatinous, irregularly lobed, the base of the frond when mature conspicuously stalked, broadly obovate or often reniform, lobes obovate, irregularly splitted, cuneately expanded, margins somewhat smooth, entire or more less minutely proliferate, proliferations obovate, orbicular, subacute. Fruits not seen. Reported for the first time from the Bombay Coast.

Habitat.—Attached to rocks, 'Kurachee', No. 42, Leg. J. A. Murray! 1881. Pl. I, fig. 4, 1/5 Nat. side.

I confirm the determination and the name noted on the sheet. This form is more allied to the variety *Undulata* but it does not tally with this variety in all respects.

FAMILY V. RHODOMENIACEAE.

5. **Halichrysis depressa** Schousb. De Toni Syllg. Alg., Florideae, vol. ii, pp. 534-35. (Plate II, fig. 1.)

Thallus about 18 cm. long and 20 cm. broad, carnose; fronds 3-8 mm. wide, membranaceous, even, more or less thick, widely expanded, irregularly lobed; lobes 2-5 mm. broad, oblong, dilated upwards, subpinnalifid upwards; fruits not seen. Reported for the first time from the Bombay Coast.

Habitat.—Attached to rocks, 'Kurachee', No. 48, Leg. J. A. Murray! 1881. Pl. II, fig. 5, 1/5 Nat. size.

This species is named *Chrysymenia depressa* Schousb. on the Herb, sheet. Examination of the actual specimens and literature proves that the specimen is a form of the species described above.

6. **Erythrocolon Muelleri** (Sond) J. Ag. De Toni Syllg. Alg., Florideae, vol. ii, p. 585. (Plate II, fig. 2.)

Thallus 15-20 cm. long and 20-30 cm. broad, gelatinous, membranaceous, spreading, purplish red; fronds cylindrical, tubular, constricted at regular intervals, divided into long pyriform joints by internal diaphragms; secondary fronds 10-16 cm. or more in length, fastigiate, regularly di- or trichotomously-branched, constricted into joint-like internodes; internodes 10-20 mm. long, 5-6 mm. broad, oblong, rounded at the apices, slightly tapering towards the base, the upper internodes short and more rounded, and each internode is surmounted by generally 2 or sometimes 3-4 similar internodes which are separated by distinct stalk-like nodes or pedicels; pedicels 1-3 mm. long and 5-1 mm. broad, slender, cylindrical, scattered over the internodes as minute tubercles. Reported for the first time from the Bombay Coast.

Habitat.—On rocks, 'Kurachee', No. 50, Leg. J. A. Murray! 1881. Pl. II, fig. 6, 1/6 Nat. size.

Chylocladia Muelleri Sond. is a synonym.

FAMILY VI. DELESSERIACEAE.

7. **Delesseria sinuosa** (Good, et Woodw.) Lamour. De Toni Syllg. Alg., Florideae, vol. ii, pp. 705-6. (Plate II, fig. 3.)

Thallus 6-10 cm. long and 5-20 mm. broad, elongate, sinuose, bright-red with widely separated fronds; fronds fasciated, leathery, ribbon-shaped, irregularly attenuated at the base, stipitate, stalk 1 mm. thick, dark rred, midrib prominent, 5-1 mm. thick, reaching half or a little above but never reaching the apices of the fronds, lateral veins absent, margin irregularly lobed or somewhat proliferate. Reported for the first time from the Bombay Coast.

Habitat.—On rocks, 'Kurachee', No. 51, Leg. J. A. Murray! 1881. Pl. II, fig. 7, 1/6 Nat. size.

The specimen which was identified as *Delesseria subdichotoma* J. Ag., as noted on the Herb sheet, has been ascertained to be a form of *D. sinuosa* (Sond) J. Ag.

FAMILY VII. GRATELOUPIACEAE.

8. **Halymenia fastigiata** J. A. De Toni Syllg. Alg., Florideae, vol. iv, p. 1541. (Plate II, fig. 4.)

Thallus 5-16 cm. long and 6-10 cm. wide, fastigiate, pink or dark pink; fronds 1-3 mm. broad, compressed, tubular, gelatinous, more or less loosely dichotomous, upper segments; sometimes spreading or furcate, attenuated towards the base, tapering acuminately into fine acute points, terminal segments often minutely proliferate. Reported for the first time from the Bombay Coast.

Habitat.—Attached to rocks, 'Kurachee', Nos. 56, 57, Leg. J. A. Murray! 1881. Pl. II, fig. 8, 1/5 Nat. size.

CLASS—PHAEOPHYCEAE (*FUCOIDEAE*).

FAMILY VIII. SARGASSACEAE.

9. **Sargassum persicum** Kuetz. De Toni Syllg. Alg., Fucoideae, p. 114. (Plate III, fig. 1.)

Thallus 15-25 cm. long and 4-15 cm. broad at the base, 10 mm. broad at the ends; primary branches of the frond 15-25 cm. long, narrow, more or less filiform, slender, terete, glabrous; secondary branches 1-8 cm. long, alternately arranged on either side of the primary branches and at a distance of about 1-3 cm. apart, these carry shorter tertiary branches in their turns; leaves variable, 2.5-4.5 cm. long, 5-19 mm. broad, marked with a distinct or slightly indistinct midrib, apex broadly or obtusely rounded, margins indistinctly denticulate or irregularly wavy, subsessile or stalked, pedicels 1-3 mm. long, .5 mm. thick; leaves of secondary branches smaller and those of tertiary still smaller and apices shortly obtuse; vesicles obovate, globose, 1-2 mm. diameter, borne on very short filiform stalk. Reported for the first time from the Bombay Coast.

Habitat.—On rocks, 'Kurachee', No. 49, Leg. J. A. Murray! 1881. Pl. III, fig. 9, 1/6 Nat. size.

FAMILY IX. DICTYOTACEAE.

10. **Padina Fraseri** (Grev.) J. Ag. De Toni Syllg. Alg., Fucoideae, p. 246. (Plate III, fig. 2.)

Thallus 12-15 cm. long, 14-15 cm. broad, brown to dark brown in colour, cuneately lobed, attached to the substratum by subconcentric basal organ with hairy rhizoids covered with chalky powder; fronds 5-16 cm. long and 1-5 cm. broad at the fanshaped apices, attenuated to 1 mm. to 5 mm. broad at the stalk-like bases, cuneated, membranous above at the broad rounded ends, somewhat subcoriaceous towards the narrowed bases, irregularly somewhat dichotomously branched by splitting up more or less deeply of the blades; lobes of the flabellated portions distinctly marked by narrow concentric bands of minute hair-like structures, 1-6 mm. apart, dark brown at the base and pale brown near the margin. Fruits not seen. Reported for the first time from the Bombay Coast.

Habitat.—On rocks, 'Kurachee', No. 40, Leg. J. A. Murray! 1881. Pl. III, fig. 10, 1/5 Nat. size.

11. **Stoechospermum maculatum** J. Ag. De Toni Syllg. Alg., Fucoideae, p. 252. (Plate III, fig. 3.)

Thallus 15 cm. long, 4 cm. broad above brown, elongate, more or less lanceolate attenuated below ending in a stalk-like base; fronds sub-fastigiate, decompositely dichotomously branched; segments lanceolate or linear-lanceolate flattened, tongue-shaped towards the apices. Fruits not seen. Reported for the first time from the Bombay Coast.

Habitat.—On rocks, 'Kurachee', No. 71, Leg. J. A. Murray! 1881. Pl. III, fig. 11, 1/5 Nat. size.

FAMILY X. LAMINARIACEAE.

12. **Phyllaria reniformis** (Lamour) Rostaf. De Toni Syllg. Alg., Fucoideae, pp. 321-22. (Plate III, fig. 4.)

Thallus about 30 cm. long and 10 cm. broad, brown or greenish brown, ovate-oblong or reuniform, fastigiate, digitately expanded, ending in somewhat solid, flattened, roundish stalks; fronds about 30 cm. long. 2-10 mm. broad, ribbon-shaped, slightly attenuated towards the base, tapering to acuminately pointed ends, membranous, segments digitate, 10 mm. broad at widest middle portion. Fruits not seen. Reported for the first time from the Bombay Coast.

Habitat.—On rocks, 'Kurachee', No. 10, Leg. J. A. Murray! 1881. Pl. III, fig. 12, 1/8 Nat. size.

Laminaria brevipes Ag. is considered o synonym of the above specific name. The species described differ from the typical form in several characters. It is therefore rightly suggested, as noted on the Herbarium sheet, to be a variety of the above species. The variety, however, can only be established by further examination of the fruits which are absent in the specimen available.

EXPLANATION OF FIGURES.

PLATE I.

Fig. 1.—*Ulva fasciata* Delile. 1/5 Nat. size.
Fig. 2.—*Scinaia furcellata* (Turn.) Biv. 1/7 Nat. size.
Fig. 3.—*Dicranema furcellatum* (Mont.) J. Ag. 1/6 Nat. size.
Fig. 4.—*Callymenia reniformis* (Turn.) J. Ag.

PLATE II.

Fig. 5.—*Halichrysis depressa* Schousb. 1/5 Nat. size.
Fig. 6.—*Erthrocolon Muelleri* (Sond) J. Ag. 1/6 Nat. size.
Fig. 7.—*Delesseria sinuosa* (Good, et Woodw.) Lamour. 1/6 Nat. size.
Fig. 8.—*Halymenia fastigiata* J. Ag. 1/5 Nat. size.

PLATE III.

Fig. 9.—*Sargassum persicum* Kuetz. 1/6 Nat. size.
Fig. 10.—*Padina Fraseri* (Grev.) J. Ag. 1/5 Nat. size.
Fig. 11.—*Stoechospermum maculatum* J. Ag. 1/5 Nat. size.
Fig. 12.—*Phyllaria reniformis* (Lamour) Rostaf. 1/8 Nat. size.

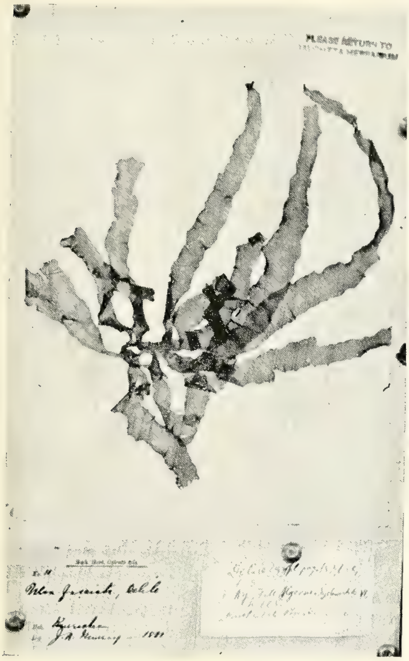
PLEASE RETURN TO
Ulva fasciata, Delile
1881

Fig. 1.—*Ulva fasciata,* Delile.

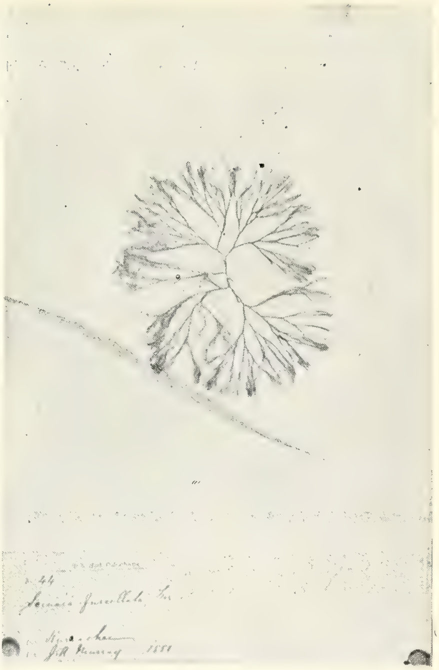

Fig. 2.—*Scinaia furcellata* (Turn.) Biv.

PLEASE RETURN TO
CALCUTTA
1881

Fig. 3.—*Dicranema furcellatum* (Mont.) J. Ag.

Fig. 4—*Callymenia reniformis* (Turn.) J. Ag.

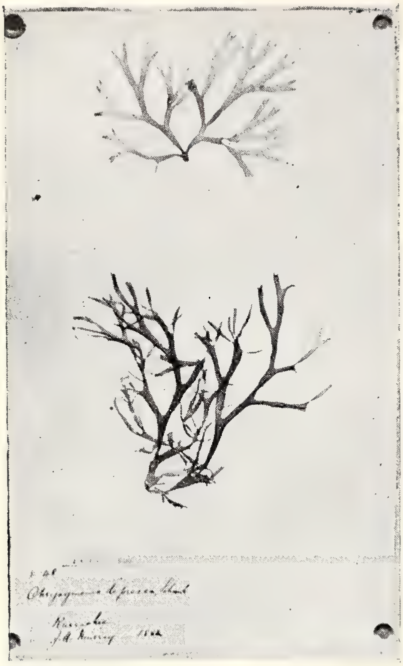

Fig. 5.—*Halichrysis depressa,* Schousb.

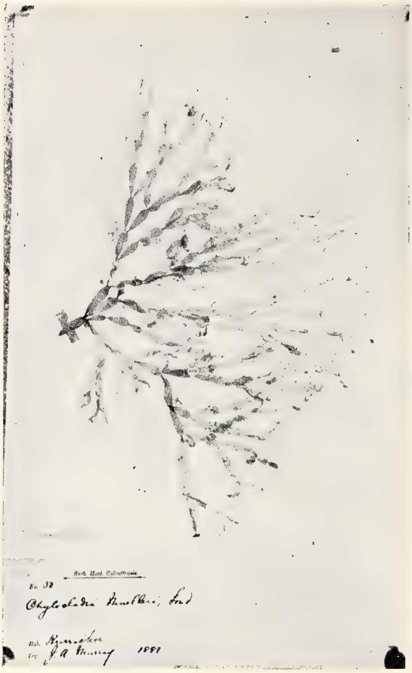

Fig. 6.—*Erthrocolon Muelleri* (Sond) J. Ag.

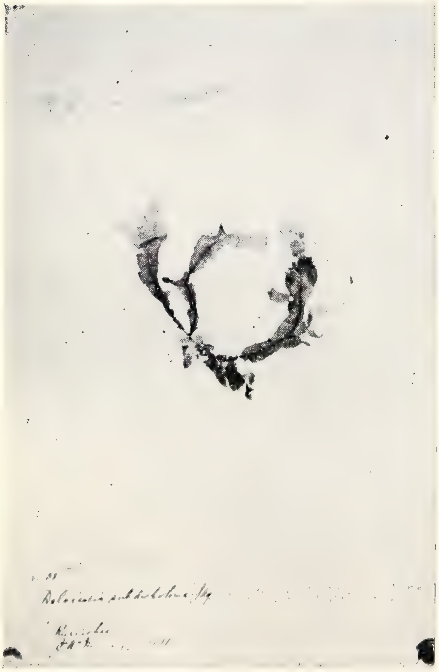

Fig. 7.—*Delesseria sinuosa* (Good, et Woodw.) Lamour.

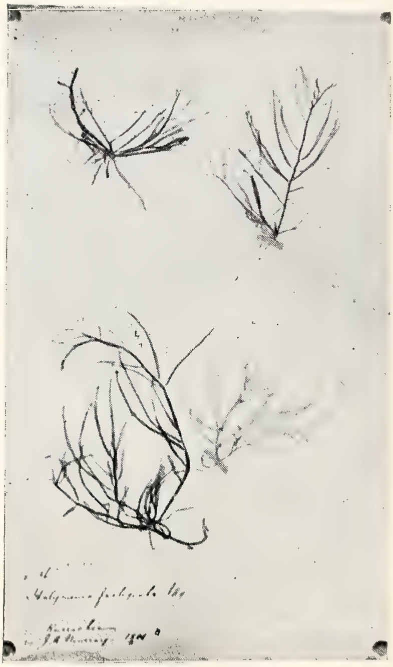

Fig. 8.—*Halymenia fastigiata,* J. Ag.

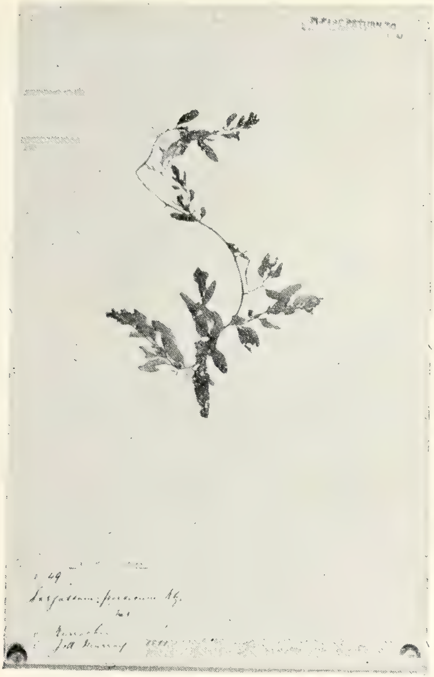

Fig. 9.—*Sargassum persicum,* Kuetz.

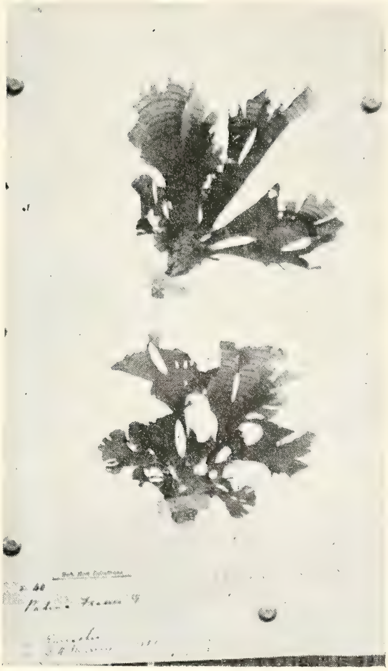

Fig. 10.—*Padina Fraseri* (Grev.) J. Ag.

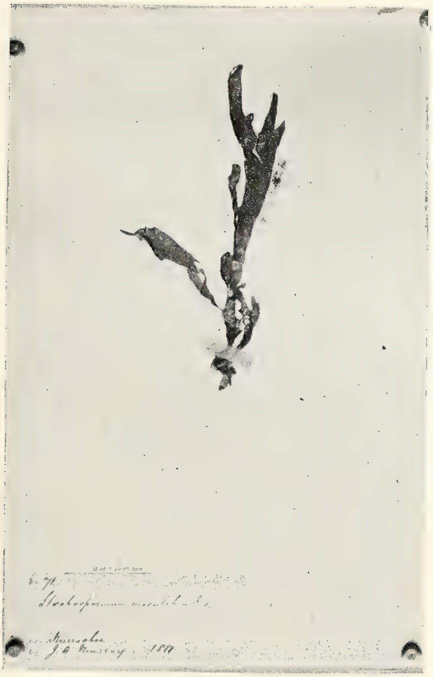

Fig. 11.—*Stoechospermum maculatum* J. Ag.

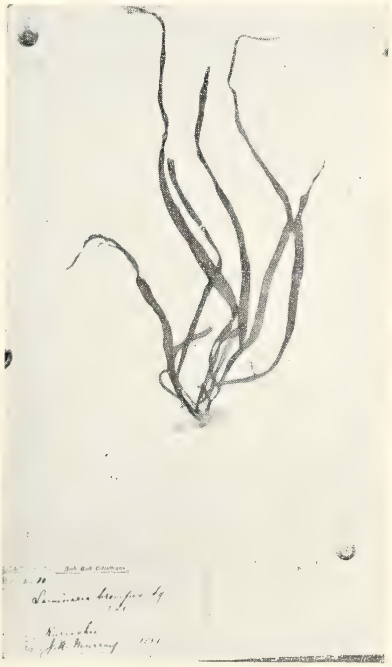

Fig. 12.—*Phyllaria reniformis* (Lamour) Rostaf.

BIRDS ON THE HINDUSTAN-TIBET ROAD, N.-W. HIMALAYA.

BY

H. W. WAITE, C.I.E., M.B.O.U.

(*With 2 plates*)

Stoliczka's 'Ornithological observations in the Sutlej Valley, N.-W. Himalaya' appeared in the *Journal of the Asiatic Society of Bengal* (Vol. xxxvii, Part ii) in 1868 and so far as I am aware no similar observations in that area have been published since. The following list of birds seen during a trek along the Hindustan-Tibet Road in April-June 1941 may therefore be of interest.

I left Simla on April 10, reached Namgia (10 miles from Shipki and 2 miles from the Tibetan frontier) on May 24 and returned to Simla on June 27. In the itinerary given below the figures in brackets denote the road mileage from Simla and the dates in italics are those of the return journey.

Simla, 7,000′.
Kufri, 8,270′ (9) 10-11 April.
Fagu, 8,200′ (12) *26 June.*
Theog, 7,500 (18) 12-13 April.
Matiana, 7,430′ (29) 14-15 April, *25 June.*
Narkanda, 9,130′ (40) 16-17 April, *24 June.*

Bagi, 8,830′ (49) *21-23 June.*
Sungri, 8,850′ (66) *18-20 June.*
Bahli, 8,100′ (77) *16-17 June.*
Taklech, 5,460′ (87) *15 June.*
Daranghati, 9,240′ (98) *13-14 June.*

Thanedar, 7,300′ (51) 18-19 April.
Nirth, 3,250′ (59) 20-21 April.
Rampur, 4,150′ (71) 22-25 April.
Gaura, 6,580′ (80) 26-27 April.

Sarahan, 6,875′ (89) 20-29 April, *11-12 June.*
Chaura, 6,650′ (98), *10 June.*
Taranda, 7,000′ (104) 30 April-2 May.
Paunda, 6,300′ (108).
Nachar, 7,090′ (112) 3-5 May, *7-9 June.*
Wangtu, 5,390′ (116).
Urni, 7,300′ (124) 6-7 May, *6 June.*
Rogi, 8,970′ (136).
Chini, 9,265′ (140) 8-11 and 14-17 May. *31 May-5 June.*
Pangi, 8,520′ (144) 12-13 and 18 May, *30 May.*
Jangi, 8,980′ (159) 19 May, *29 May.*
Kanam, 9,200′ (172) 20-21 May, *27-28 May.*
Poo, 8,400′ (187) 22-23 May, *26 May.*
Namgia, 9,750′ (194) 24-25 May.

Beyond Narkanda the road descends to the bank of the Sutlej at Nirth and thence continues along the south side of the valley to Wangtu. Between Narkanda and Thanedar a high-level branch takes off and runs along the north side of the Hathu range to Bagi and Bahli. From there it descends to Taklech and then climbs to Daranghati, whence it drops to rejoin the main road about two miles short of Sarahan. At Wangtu the road crosses to the right bank of the river and runs high above it to Kanam. From Kanam it drops to cross to the left bank again between Poo and Namgia and so on to Shipki.

The physiography of the Sutlej Valley is thus described by Stoliczka:—

> 'Proceeding westwards from the Kanawar frontier, near Shipki, we find that the Sutlej has forced its passage through the principal N.-W. Himalayan chain, cutting its bed to a depth of several thousand feet. Former terraces and old gravel beds of the river (and also of its tributaries) are seen, three and four thousand feet above the present level, which descends from about 8,000′ at Shipki to 3,000′ below Kotegarh. Within this entire length (amounting to about 160 miles) from Shipki to Suni (north of Simla) the Sutlej flows in a narrow channel between perpendicular cliffs of gneiss, the width of which seldom exceeds a few hundred feet. The Wanga and Baspa rivers, both of which are situated within the branches of the Central Himalayan chain, are the only large tributaries on the Indian slopes. (The longest tributary is the Spiti river:* its valley has in general rather a Tibetan climate and a corresponding fauna and flora.)
>
> The highest peaks in the Central chain rise on an average somewhat over 22,000′ and the limit of snow lies in general at about 17,000′, increasing to about 18,500′ on the Tibetan slopes.
>
> In the Sutlej valley itself only the higher terraces, situated between 6,000′ and 9,000′ are generally sufficiently large to afford room for cultivation and settlement, the slopes of the mountains being mostly precipitous. The width of the valley is even at these higher elevations merely a few miles. On the whole its physical conditions are not particularly favourable to agriculture, nor is there much room for a large population. . . . Viewing the general physical construction of the valley within the Central chain of the N.-W. Himalaya the greatest peculiarity consists in its small width, while the neighbouring hills rise to a very considerable elevation, and thus exhibit very different conditions of climate within a comparatively small geographical area.'

As regards rainfall, there is a moist zone in the lower 30 miles of the valley up to Wangtu, a dry zone in the next 20 miles and an arid zone in the upper 30 miles to the Tibetan frontier, where the monsoon nearly peters out. The figures of rainfall of Kotagarh (moist zone) and Kilba (near Urni, dry zone) are:—

	Dec.-Feb.	Mar.-May	June-Sept.	Oct.-Nov.	Total
Kotegarh	5.80	9.38	28.04	1.38	44.56
Kilba	8.63	11.18	10.68	1.92	32.41

Forest ceases at about Kanam, and beyond that the mountain sides are mostly bare.

Owing to the great depth and narrow width of the valley to cover any appreciable amount of ground entails strenuous climbing. Unfortunately ill-health severely curtailed my activities, and but for the efforts of my shikari, Lala Sheikh, the following list would have been even shorter than it is.

In the cases of birds marked with an asterisk specimens were obtained and these were identified by the late Hugh Whistler, to whom, and to Mr. A. E. Jones, I am indebted for much valuable advice and assistance.

For the convenience of those to whom old volumes of the *J.A.S.B.*, are not readily available I have added Stoliczka's remarks, including those on species which were not observed.

***Corvus macrorhynchos intermedius** Adams. Himalayan Jungle Crow.

Common throughout the valley and observed right up to the Tibetan frontier.

***Urocissa erythrorhyncha occipitalis** (Blyth). Red-billed Blue Magpie.

Frequently met with as far as Taranda. Not seen beyond that nor lower than about 7,000′.

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* The Spiti river joins the Sutlej a little below Namgia.

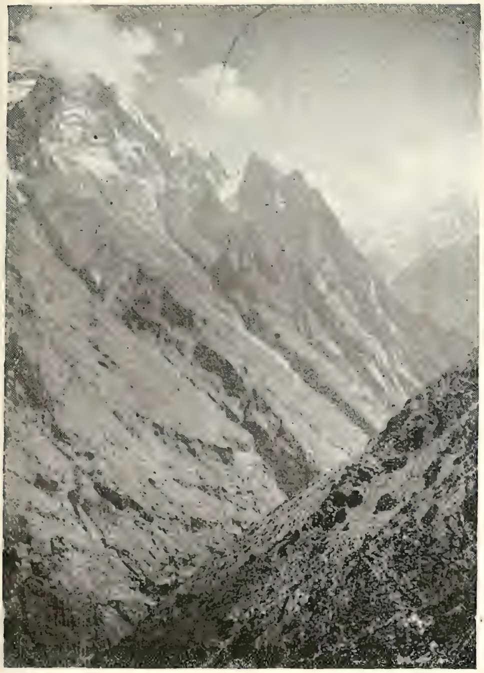


Fig. 1.—Between Namgia and Shipki.

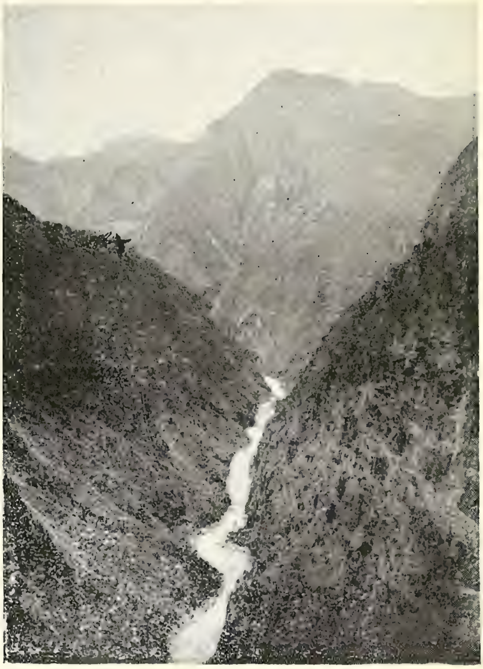


Fig. 2.—The Sutlej between Taranda and Chaura.

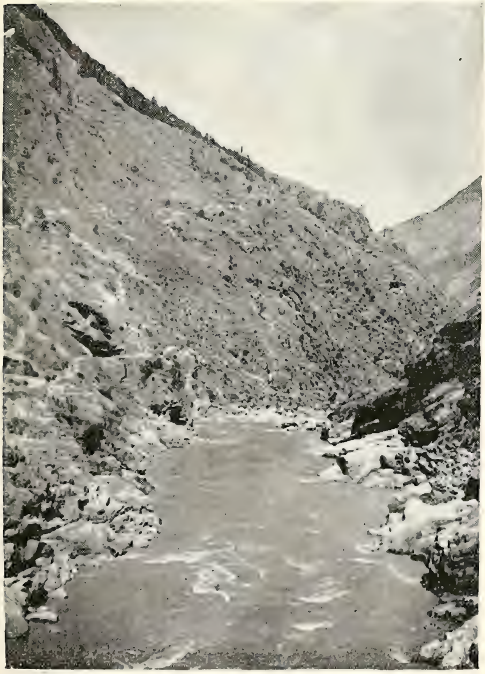


Fig. 3.—The Sutlej at Wangtu.

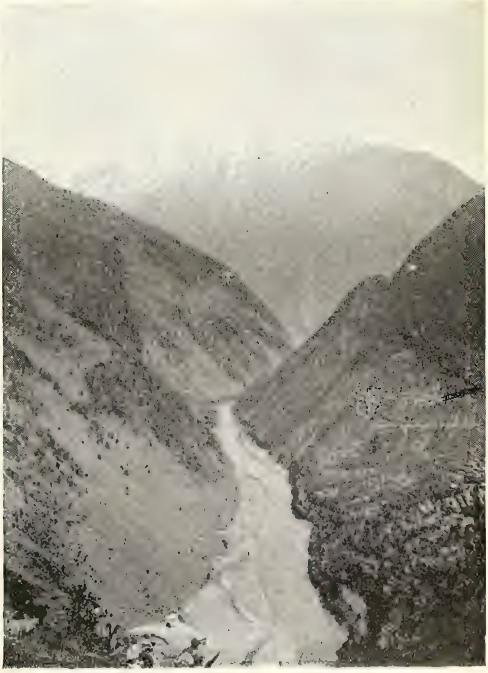


Fig. 4.—The Sutlej between Urni and Rogi.

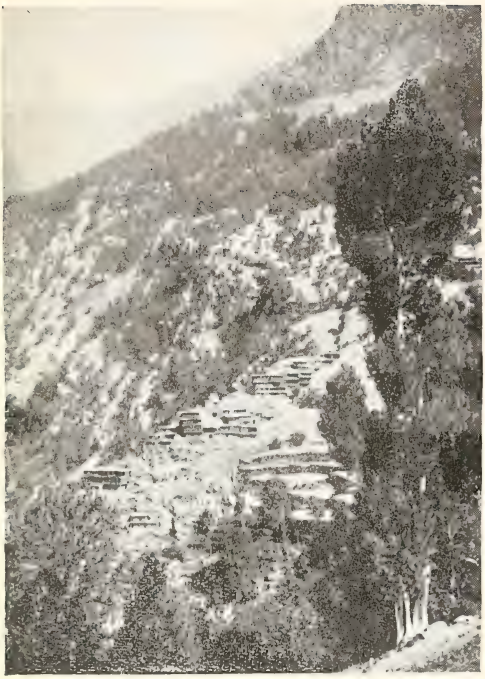


Fig. 5.—Pangi Village.

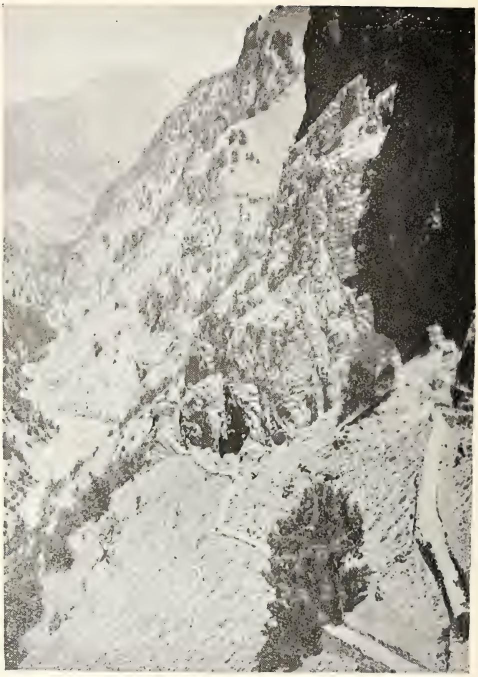


Fig. 6.—The Road in the Lipi Valley between Jangi and Kanam.

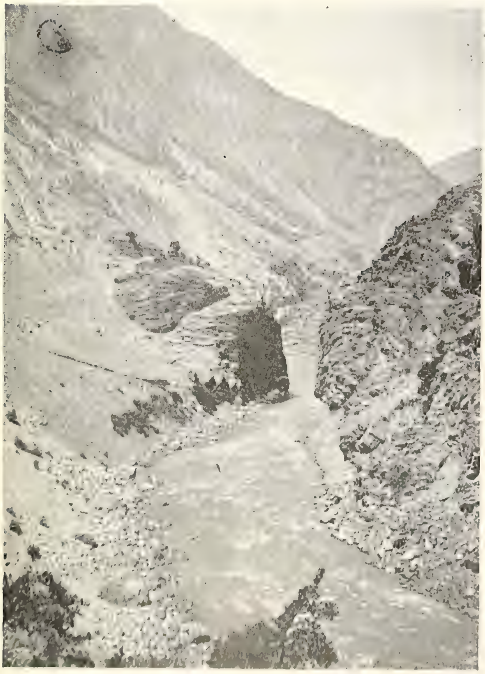


Fig. 7.—The Bridge over the Sutlej between Poo and Namgia.

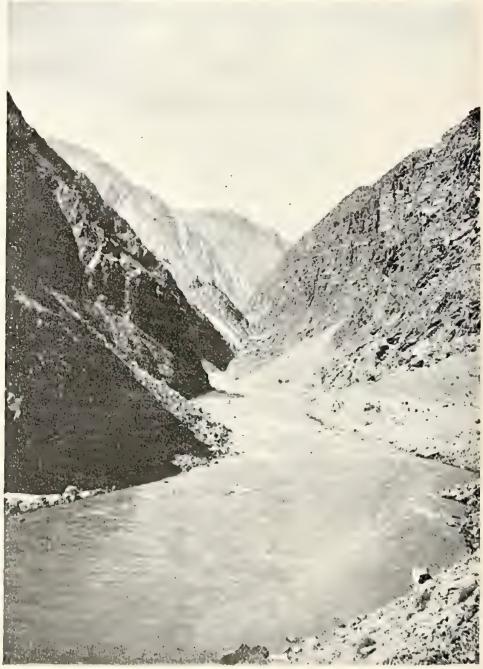


Fig. 8.—The Sutlej between Poo and Kanam.

Dendrocitta vagabunda Lath. Tree-pie.

Seen between Nirth and Rampur.

***Garrulus lanceolatus** Vigors. Black-throated Jay.

Observed as far as Taranda but not beyond that nor below about 7,000′.

***Nucifraga caryocatactes hemispila** Vigors. Himalayan Nut-cracker.

Frequently seen between Fagu and Sungri but not further east. Stoliczka noted that it was common from Simla to Chini.

***Pyrrhocorax pyrrhocorax himalayanus** (Gould). Red-billed Chough.

First seen between Pangi and Jangi and commonly thence to Namgia. Stoliczka noted it as rare in summer round Chini.

***Parus major caschmiriensis** Hart. Kashmir Grey Tit.

Only observed at comparatively low elevations in the neighbourhood of Rampur, Gaura and Taklech.

***Parus monticolus monticolus** Vigors. Green-backed Tit.

Commonly met with as far as Pangi, but not below 7,000′. One was seen carrying moss to a hole in a bank at Kufri on April 10, and a pair was feeding young in a hole in the wall of Daranghati Rest House on June 13.

***Lophophanes melanolophus** (Vigors). Crested Black Tit.

Common as far as Chini, but not seen below 7,000′. One was collecting moss at Narkanda on April 17, and a nest with 4 eggs was found above Chini on May 10.

***Lophophanes rufonuchalis rufonuchalis** (Blyth). Simla Black Tit.

Observed about Chini and Kanam and also at Bagi, where it appeared to be fairly common.

***Lophophanes dichrous kangrae.** Whistler. Brown-crested Tit.

A male with organs in breeding condition was obtained above Taranda on May 2. Occasionally seen at Sungri and Bagi. Not mentioned by Stoliczka.

[**Sylviparus modestus** Burton. Yellow-browed Tit.

Stoliczka recorded that this species was 'in summer common on the apricot trees about Pangi and Chini'. Although specially looked for at both of these places it was not observed.]

Machlolophus xanthogenys (Vigors). Yellow-cheeked Tit.

Only seen in the neighbourhood of Bahli and Sungri.

***Aegithaliscus concinnus iredalei** Stuart Baker. Red-headed Tit.

Met with from Sarahan to Nachar and also at Thanedar, Bahli and Sungri.

***Sitta leucopsis leucopsis** Gould. White-cheeked Nuthatch.

This Nuthatch is still, as Stoliczka recorded, tolerably common in the neighbourhood of Chini. It was also obtained at about 9,000′ between Sungri and Bagi.

* **Garrulax albogularis whistleri** Stuart Baker. Western White-throated Laughing Thrush.

Several were seen singly above Thanedar.

***Trochalopteron variegatum variegatum** (Vigors). Eastern Variegated Laughing Thrush.

Noted as common from Thanedar to Nachar, but not seen beyond that. Also observed about Daranghati, Sungri and Bagi. Two nests containing two and four eggs respectively were found at Rampur on April 24. According to

Stoliczka it occurs 'through the entire extent of the Sutlej valley up to Sungnum' (Sungnum is on the branch road which takes off between Kanam and Poo and goes to Dhankar in Spiti).

[**Pomatorhinus erythrogenys** Vigors. Vigor's Rusty-cheeked Scimitar-Babbler.

Stoliczka recorded that this species was 'not common in the forests and thick brushwoods between Kotegarh and Nichar'.]

***Stachyridopsis pyrrhops** (Blyth). Red-billed Babbler.

Only met with at Taklech, where a nest with one addled and two hard-set eggs was found on June 16. The nest was on the ground in a small bamboo clump on the edge of a brook. It was a compact structure of bamboo leaves and grass, and the fairly substantial foundation was completely sodden.

[**Fulvetta vinipecta** (Hodgs.). Hodgson's Fulvetta.

Recorded by Stoliczka from Matiana. Mr. A. E. Jones obtained it at Narkanda (*J.B.N.H.S.*, xxvi, 604).]

***Leioptila capistrata pallida** Hart. Pale Sibia.

A pair was seen near Sarahan in April and another in the same place in June.

***Siva strigula strigula** Hodgs. Stripe-throated Siva.

A pair was obtained at Sarahan in April and a male at Bagi in June. Stoliczka says that this species 'in summer frequents thick forests, between 6,000 to 9,000′ all along the elevated range from Simla to Nachar'.

***Ixulus flavicollis albicollis** Ticehurst and Whistler. Yellow-headed Ixulus.

A male was secured at Bahli, the only one seen.

[**Pteruthius erythropterus** (Vigors). Red-winged Shrike-Babbler.

Stoliczka says 'as far east as Nichar. Seen at Sarahan between 9,000 and 10,000′. Rare.']

***Microscelis psaroides psaroides** (Vigors). Himalayan Black Bulbul.

Commonly seen as far as Pangi. Stoliczka found it 'common in the forests between Kotegarh and Nachar'.

Molpastes leucogenys leucogenys (Gray). White-cheeked Bulbul.

Not observed beyond Sarahan, but common as far as that. According to Stoliczka it is occasionally to be seen as far east as Chini.

***Certhia himalayana himalayana** (Vigors). Himalayan Tree-creeper.

Met with from Narkanda to Bahli and also about Rogi and Chini.

***Troglodytes troglodytes neglectus** (Brooks). Kashmir Wren.

Fairly common about Chini and also seen at Nachar. Young birds were seen at Chini on June 3.

[**Pnoepyga albiventer** (Gould). Scaly-breasted Wren.

Stoliczka says 'very rare in the forests about Nachar and Chini; it is found about Kotegarh in winter'.]

***Cinclus pallasii tenuirostris** Bonaparte. Indian Brown Dipper.

Seen on streams about Chini and Pangi.

Saxicola caprata bicolor Sykes. Pied Bush-Chat.

Only seen in the neighbourhood of Nirth and Rampur. Stoliczka found it 'common all through the Sutlej valley up to Nachar'.

***Saxicola torquata indica** Blyth. Indian Bush-Chat.

Common as far as Chini; also observed between Pangi and Jangi. A nest with four eggs was found, at about 10,000′ above Chini on May 15.

***Oreicola ferrea ferrea** (Gray). Dark-grey Bush-Chat.

Commonly seen as far as Chini, where Stoliczka says it breeds. A nest with three eggs was found at Gaura on April 27.

***Oenanthe pleschanka pleschanka** (Lepschin) Pied Chat.

Not uncommon on the bare hillsides about Kanam and Poo. Not mentioned by Stoliczka.

***Enicurus maculatus maculatus** Vigors. Western Spotted Forktail.

Seen about Nirth and Gaura and at Taklech.

***Phoenicurus frontalis** (Vigors). Blue-fronted Redstart.

Met with at Chini and Pangi and high above Nachar. Not mentioned by Stoliczka.

Phoenicurus ochruros (Gmel.). Black Redstart.

A few were seen across the Tibetan frontier between Namgia and Shipki on May 25; they were extremely wild.

Chaimarrhornis leucocephala (Vigors). White-capped Redstart.

Observed between Sarahan and Taranda.

Rhyacornis fuliginosa (Vigors). Plumbeous Redstart.

Frequently seen from Wangtu onwards as far as Kanam.

***Calliope pectoralis pectoralis** Gould. Himalayan Rubythroat.

A fair number seen, amongst boulders and scrub, above Chini in May and June. There was a marked preponderance of males.

***Tarsiger chrysaeus whistleri** Ticehurst. Golden Bush-Robin.

The male of a pair was secured above Nachar on May 5. Stoliczka noted that he had never met this species on his summer visits to the Sutlej valley.

***Ianthia cyanura pallidior** Stuart Baker. Kashmir Red-flanked Bush-Robin.

Observed at Nachar and Chini. One was also obtained above Taranda on May 2 and a juvenile at Bagi on June 22. Stoliczka says 'this species does not occur in summer to the west of Nachar and not below 8,000′. It breeds near Chini.'

***Adelura coeruleocephala** (Vigors). Blue-headed Robin.

Frequently seen from Urni to Pangi. Stoliczka says 'occurs plentifully beyond Pangi and about Chini, generally on small streams; it also breeds here'.

***Turdus merula maximus** (Seebohm). Central Asian Blackbird.

A pair, the only ones seen, was obtained above Chini on June 1. It is not mentioned by Stoliczka, and this appears to be an extension of its known range.

***Turdus merula albocinctus** Royle. White-collared Ouzel.

Several were observed singly near Narkanda in April and a pair at Daranghati in June.

***Arceuthornis viscivorus bonapartei** (Verr.). Missel Thrush.

A pair was obtained from a flock near Narkanda in April. Also seen between Bagi and Narkanda in June. According to Stoliczka it breeds about Chini.

***Oreocincla dauma dauma** (Lath.). Small-billed Mountain-Thrush.

A juvenile male was obtained on Mount Hathu, between Narkanda and Bagi on June 24. (Two other juvenile thrushes were secured at Sungri and Bagi but it could not be determined with certainty to which species they belonged.)

***Monticola rufiventris** (Jard. and Selby). Chestnut-bellied Rock-Thrush.

Met with in the neighbourhood of Sungri. Stoliczka says 'only found in the lower hills about Simla and Kotegarh'.

***Monticola cinclorhyncha** (Vigors). Blue-headed Rock-Thrush.

Several were observed at Taranda and Nachar, and it was also seen at Pangi. Stoliczka found it 'common about Sarahan and Nachar but rare at Chini'.

***Myophonus temminckii temminckii** (Vigors). Himalayan Whistling-Thrush.

Common all the way from Simla to Namgia. Stoliczka noted that it bred at Chini and Sungnum.

***Prunella strophiata jerdoni** (Brooks). Jerdon's Accentor.

An adult male and a juvenile were secured above Chini at the beginning of June. Stoliczka says 'occasionally comes in winter to Kotegarh and to other Himalayan parts of the Sutlej valley'.

***Hemichelidon sibirica gulmergi** Stuart Baker. Kashmir Sooty Flycatcher.

Only seen at Nachar. Stoliczka says 'very common between 4,000 and 11,000', at which elevations I have often found it in the neighbourhood of Chini'.

***Siphia strophiata euphonia** Koelz. Orange-gorgetted Flycatcher.

Obtained at Narkanda in April and Sungri in June. Stoliczka noted that it only came in winter to Kotegarh and even then was rather rare.

***Cyornis superciliaris superciliaris** (Jerd.). White-browed Blue Flycatcher.

Stoliczka's remark that this is one of the most common birds in the Sutlej valley and is seen all the way to Pangi still holds good. A nest with four eggs was found at Urni on May 7.

Eumyias thalassina (Swains). Verditer Flycatcher.

Frequently seen as far as Taranda. Stoliczka noted that it did not go eastwards of the Nachar forests.

***Alseonax ruficaudatus** (Swains.). Rufous-tailed Flycatcher.

Only seen at Urni, where a pair was obtained in May. Stoliczka found it 'abundant among apricot trees near Chini and Pangi'.

***Culicicapa ceylonensis pallidior** Ticehurst. Simla Grey-headed Flycatcher.

Met with from Taranda to Nachar and was common at Taklech.

***Tchitrea paradisi leucogaster** (Swains.). Himalayan Paradise Flycatcher.

Only seen at Rampur and Taklech. Stoliczka says 'rather rare in eastern portions of the Sutlej valley; I have never seen it much beyond the Nachar forests and above elevations of 9,000' '.

***Lanius shach erythronotus** (Vigors). Rufous-backed Shrike.

Observed at Rampur and Gaura and was not uncommon about Sarahan and Chini. Whistler noted on four specimens collected that they were intermediate with *tephronotus* but closer to *erythronotus*.

[**Lanius isabelinus** H. and E. Isabelline Shrike.

Stoliczka noted that he once met with this shrike east of Chini.]

***Pericrocotus brevirostris brevirostris** (Vigors). Short-billed Minivet.

Common as far as Pangi but not seen below 7,000'.

***Dicrurus longicaudatus** Hay. Indian Grey Drongo.

Common from Matiana to Sarahan and observed as far as Urni.

***Sylvia althaea** Hume. Hume's Lesser Whitethroat.

A male was obtained at Urni on May 7 and another near Kanam on May 29. Stoliczka does not mention any Whitethroat.

***Phylloscopus affinis** (Tick.). Tickell's Willow-Warbler.

One was obtained at Chini on May 9.

***Phylloscopus trochiloides nitidus** (Blyth). Green Willow-Warbler.

Met with at Thanedar and between Nirth and Rampur.

***Phylloscopus trochiloides ludlowi** Whistler. Dull Green Willow-Warbler.

A female was shot from a nest above Nachar, at about 10,000′, on June 8. The nest, a loosely made domed structure of grass without any moss, and lined with a few Monal feathers, was on the ground amongst birch saplings and contained four fresh eggs. A fifth egg was about to be laid.

***Phylloscopus occipitalis occipitalis** (Blyth). Large-crowned Willow-Warbler.

Obtained at Fagu, Chini and Namgia. A male shot at Namgia was evidently breeding.

Seicercus xanthoschistos (Gray). Grey-headed Flycatcher Warbler.

Seen at Taranda in May.

***Horornis pallidus** (Brooks). Pale Bush-Warbler.

Common, and calling freely, round about Sungri; also met with near Narkanda in June.

***Suya crinigera crinigera** Hodgs. Brown Hill-Warbler.

Common about Rampur, Sarahan and Taranda; also observed at river level between Wangtu and Urni. Stoliczka noted that it did not go very far into the interior.

***Cephalopyrus flammiceps flammiceps** Burton. Fire-capped Tit-Warbler.

A male obtained at Gaura was the only one seen.

Oriolus oriolus kundoo Sykes. Golden Oriole.

Seen at Rampur and heard at Sarahan and Chini.

Stoliczka remarked that it was occasionally seen between Kotegarh and Rampur.

Acridotheres tristis tristis (L.). Common Mynah.

Observed as far as Sarahan, where it appeared to be common.

***Perissospiza icteroides** (Vigors). Black-and-yellow Grosbeak.

Met with in parties about Narkanda in April; also found at Gaura and Nachar. At Narkanda one was seen foraging on a garbage heap by the side of the road.

***Mycerobas melanoxanthus** (Hodgs.). Spotted-winged Grosbeak.

In June a few were seen near Sarahan and in the forests between that place and Daranghati. Not mentioned by Stoliczka.

***Pyrrhula erythrocephala** (Vigors). Red-headed Bullfinch.

Seen above Nachar and Chini in May. Stoliczka noted that it bred about Kotegarh between 6,000 and 8,000′.

[**Loxia curvirostra himalayana** Blyth. Himalayan Crossbill.

Stoliczka noted that the Crossbill was 'only to be found in the forests about Chini and towards the east'.]

***Carpodacus pulcherrimus pulcherrimus** (Moore). Beautiful Rose Finch.

Found in fair numbers above Chini in May and June; also obtained above Nachar in June. Not mentioned by Stoliczka.

***Carpodacus rhodochlamys grandis** Blyth. Red-mantled Rose Finch.

Sparingly met with above Chini, between Jangi and Kanam and about Namgia.

***Carpodacus rhodochroa** (Vigors). Pink-browed Rose Finch.

Not uncommon at about 10,000′ above Nachar, Chini and Pangi both in May and June.

***Carpodacus erythrinus roseatus** (Hodgs.). Common Rose Finch.

Seen commonly at Rampur, between Wangtu and Urni and at Chini and Pangi in May.

***Callacanthis burtoni** (Gould). Red-browed Finch.

Two pairs were obtained, and a few others seen, at Chini in June.

***Serinus pusillus** (Pall.). Gold-fronted Finch.

Numerous flocks proceeding up the valley were observed almost daily all the way from Rampur to Namgia. The last were seen between Jangi and Pangi on May 30.

***Hypacanthis spinoides** (Vigors). Himalayan Green Finch.

First met with about Chini in June. Later it was seen frequently from Daranghati to Matiana.

Gymnorhis xanthocollis (Burton). Yellow-throated Sparrow.

Seen at Nirth and Rampur.

***Passer domesticus indicus** Jard. and Selby. Indian House-Sparrow.

Noted at Rampur, Gaura, Sarahan and Poo.

***Passer rutilans cinnamomeus** (Gould). Cinnamon Tree-Sparrow.

Observed at Gaura, Taranda and Chini and between Taklech and Bahli.

***Fringilauda nemoricola altaica** (Eversm.). Stoliczka's Mountain-Finch.

Met with in flocks above Chini in the second week of May and also obtained above Kanam in the last week of that month.

***Emberiza fucata arcuata** Sharpe. Indian Grey-headed Bunting.

A few were seen between Narkanda and Matiana in June.

***Emberiza stewarti** Blyth. White-capped Bunting.

Common from Nachar to Poo. On the return journey it was seen frequently from Sarahan to Bagi. Stoliczka says, 'In the Sutlej valley it is scarcely seen west of Wangtu bridge, but is very common about Chini and further to east. . . . I found young birds about the middle of June.'

***Emberiza cia stracheyi** Moore. Eastern Meadow-Bunting.

Common in April about Fagu and Theog.

***Melophus lathami subcristata** (Sykes). Crested Bunting.

Only seen at Nirth.

Krimnochelidon rupestris (Scop.). Crag Martin.

Occasionally seen from Wangtu to Namgia.

Hirundo daurica nepalensis Hodgs. Hodgson's Striated Swallow.

Observed on the outward journey at Matiana, where a pair was completing a nest on April 15, and from Thanedar to Sarahan. On return noted at Pangi and from Daranghati to Fagu.

Motacilla alba personata Gould. Masked Wagtail.

A few seen along the river from Nirth to Rampur.

***Motacilla alba alboides** Hodgs. Hodgson's Wagtail.

A few observed on river-side shingle between Kanam and Poo, and a male obtained had its organs in breeding condition. One was also seen in the Hubsang Khad which marks the Tibetan boundary two miles beyond Namgia.

Motacilla cinerea caspica (Gmel.). Eastern Grey Wagtail.

One was seen on the road at Narkanda on April 17.

***Anthus trivialis haringtoni** Witherby. Witherby's Tree-Pipit.

One was obtained above Nirth.

***Anthus hodgsoni berezowskii** Sarudny. Kansu Tree Pipit.

A female was shot from a nest with four eggs in a forest clearing above Taranda at about 9,000′ on May 1. Another was obtained a few days later above Nachar.

***Anthus similis jerdoni** (Finsch). Brown Rock Pipit.

Only seen above Nirth.

***Anthus roseatus** Hodgs. Hodgson's Pipit.

Met with in May above Nachar and Chini at about 10,000′.

***Oreocorys sylvanus** (Hodgs.). Upland Pipit.

Seen and heard commonly in suitable localities between 4,000 and 8,000′ as far as Wangtu.

Zosterops palpebrosa (Temm. and Schlegel). White-eye.

Noted at Gaura and Nachar. Stoliczka found it breeding above Chini and says 'it is very common all through the valley as far as any rich arboreal vegetation exists'.

[**Æthopyga gouldiae** Vigors. Mrs. Gould's Yellow-backed Sunbird.

Stoliczka says 'very common at Kotegarh and through the whole valley as far east as Chini, living here at an elevation of between 9,000 and 10,000′ '.]

Cinnyris asiatica (Lath.). Purple Sunbird.

Only seen between Nirth and Rampur. According to Stoliczka it occurs as far east as Wangtu.

***Picus squamatus squamatus** Vigors. Scaly-breasted Green Woodpecker.

Frequently seen as far as Taranda. Stoliczka noted that it was common all through the forests up to Chini and ascended to elevations of nearly 11,000′.

***Dryobates himalayensis himalayensis** (Jard. and Selby). Western Himalayan Pied Woodpecker.

Commonly met with as far as Kanam, where a pair was seen feeding young on May 20. A nest, with entrance 6 ft. from the ground, in the trunk of an apricot tree a few yards from the Rest House at Pangi contained three-fledged young on May 30. Stoliczka says 'common in the cedar and fir forests all through the valley as far east as Chini'.

***Dryobates auriceps** (Vigors). Brown-fronted Pied Woodpecker.

Not seen beyond Thanedar. Stoliczka says 'I have not seen it to the East of Nachar but about Gaura it occurs at elevations of 8,000 and 9,000′ ', [**Vivia innominatus** (Burton). Speckled Piculet.

Said by Stoliczka to occur about Sarahan.]

Megalaema virens marshallorum Swinhoe. Great Himalayan Barbet.

Common as far as Taranda.

***Cuculus canorus canorus** L. Common Cuckoo.

Common as far as Pangi.

***Cuculus optatus** Gould. Himalayan Cuckoo.

Heard almost as frequently as the last as far as Chini. Not mentioned by Stoliczka.

***Cuculus poliocephalus poliocephalus** Lath. Small Cuckoo.

Obtained in June at Chini, Sungri and Bagi and also met with between Narkanda and Matiana. Stoliczka remarked that it was 'very rare in the interior of the N.-W. Himalayas'.

***Hierococcyx sparveroides** Vigors. Large Hawk Cuckoo.

First heard between Bahli and Sungri and then frequently round about Bagi. The birds were calling high up in densely foliaged trees, and it was with considerable difficulty that a specimen was secured on Mount Hathu, between Bagi and Narkanda.

Clamator jecobinus (Bodd.). Pied Crested Cuckoo.

First observed at Sarahan on June 11 and subsequently seen at Matiana.

Psittacuia cyanocephala (L.). Blossom-headed Paroquet.

Only seen in the neighbourhood of Sungri.

[**Psittacula schisticeps** (Hodgs.).

Stoliczka says that this Paroquet is rather common in the neighbourhood of Chini, where he found it breeding. He adds that towards the end of August 'its shrieking voice may be heard between Sarahan and Nachar almost in every ravine wherever the elder and the elm are abundant, on the seeds of which it principally feeds'.]

Upupa epops L. Hoopoe.

Seen at Nirth, Rampur, Sarahan, Nachar and Sungri.

Micropus melba (L.). Alpine Swift.

Micropus pacificus Lath. White-rumped Swift.

Alpine Swifts were seen in company with what I took to be *M. pacificus* at Gaura and Bahli.

Micropus apus (L.). Common Swift.

What appeared to be this species was seen sparingly at Chini and in considerable numbers at Pangi and Kanam.

[**Asio otus** (L.). Long-eared Owl.

Stoliczka says that he found this Owl common near Nachar.]

[**Strix nivicola** (Blyth). Himalayan Wood-Owl.

Stoliczka obtained it at Chini and an Owl seen there by my shikari was probably of this species.]

[**Otus spilocephalus** (Blyth). Spotted Scops Owl.

What was believed to be the call of this Owl was heard during the night at Taklech.]

***Glaucidium brodei brodei** (Burton). Western Collared Pigmy Owlet.

Met with at Bahli and Bagi.

Gyps himalayensis Hume. Himalayan Vulture.

Seen frequently as far as Kanam.

Neophron percnopterus (L.). White Scavenger Vulture.

Observed at Narkanda, Rampur, Gaura and Taranda in April and at Sarahan in June. Stoliczka says 'often seen in summer in the lower ranges about Belaspoor and Suket, but is almost never to be observed further in the interior'.

Gypaëtus barbatus (L.). Bearded Vulture.

Noted at Pangi, Chaura and Bagi. Stoliczka remarked that it was common all through the Sutlej Valley and permanently resided about Chini.

Falco subbuteo (L.). Hobby.

A pair was seen frequently about Nachar in May. They were much worried by Jungle Crows and were still there when I returned a month later.

***Falco tinnunculus tinnunculus** L. Kestrel.

Observed between Thanedar and Nirth, about Sarahan and Taranda, and at Pangi and Chini. A pair was seen feeding well-grown young on a ledge immediately above the road at Sarahan on June 12.

Aquila chrysaëtos daphanea Hodgs. Golden Eagle.

I saw what I thought was a pair of Golden Eagles on the wing between Matiana and Narkanda on April 14. Mr. C. H. Donald, who has taken nests near Bagi, Daranghati and Kilba (opposite Urni) states that it is 'to be met with right along the Sutlej watershed, from Kotegarh to the Kailas Range, in suitable localities' (*J.B.N.H.S.*, xxvi, 632).

Milvus migrans (Bodd.). Common Pariah Kite.

Only seen at Rampur.

***Accipiter nisus melanoschistos** Hume. Indian Sparrow Hawk.

A male was obtained near Namgia.

***Spenocercus sphenurus sphenurus** (Vigors). Wedge-tailed Green Pigeon.

One of a pair was secured at Gaura.

Columba livia Gmel. Blue Rock Pigeon.

Common in the river gorge between Poo and Namgia.

***Streptopelia orientalis meena** Sykes. Indian Rufous Turtle Dove.

Common as far as Nachar and frequently seen from Chini to Kanam. Stoliczka says 'is only found in summer in the lesser ranges and does not go far in the interior. I have not seen it beyond Kotegarh.'

[**Dendrotreron hodgsoni** (Vigors). Speckled Wood Pigeon.

Stoliczka found this Pigeon 'tolerably common near Chini and somewhat further to east'.]

Streptopelia senegalensis (L.). Little Brown Dove.

Only seen round about Thanedar and Nirth.

[**Catreus wallichii** (Hardw.). Cheer Pheasant.

Stoliczka says 'does not usually go beyond Nachar forests. Said to be very rare near Chini.']

***Pucrasia macrolopha macrolopha** (Less.). Koklas Pheasant.

Seen round about Narkanda, above Gaura and at Daranghati.

Gennaeus hamiltoni (Griff.). White-crested Kalij Pheasant.
Stoliczka says that this Pheasant occurs at Chini.]

Lophophorus impejanus (Lath.). Monal.
Seen above Taranda and at Daranghati. Its feathers were found in a Willow-Warbler's nest above Nachar.

Arborophila torqueola Valenc. Hill-Partridge.
Several were heard calling between Bagi and Narkanda.

***Alectoris graeca chukar** (Gray). Chukor.
Heard calling below Nachar and Sungri and many coveys were seen between Kanam and Namgia.

Francolinus francolinus (L.). Black Partridge.
Common at Sarahan. Also seen at Nirth, Taklech and Matiana and below Bahli and Sungri.

Tetrogallus sp.? Snow-Cock.
A solitary bird was seen above Namgia.

[**Scolopax rusticola** (L.). Woodcock.
Stoliczka says that the Woodcock breeds about and beyond Chini.]

TROUT OF TRAVANCORE

BY

W. S. S. MACKAY

[*Continued from Vol.* 45, *No.* 3 (1945) *p.* 373.]

PART II

(*With 2 plates*)

VI.—RIVER AND HATCHERY IMPROVEMENT.

Under ideal conditions Rainbows would have shade, fast running water, gravel, and rocky runs leading into deep pools overhung with trees and bushes. Such conditions are to be found on the Rajamallay river and prophecies of success there made previously had been more than fully justified by 1945.

Rainbows like the fast rocky runs of a river and generally seek them out. Brown Trout on the other hand prefer quiet pools and slow running flats such as Upper Eruvikulam. Rainbows however lose none of their fighting qualities if placed in such water, a fact that is amply borne out by our fine fighters in the Devicolam Loch. Most of the Rajamallay river is fishable but there are certain barren reaches which would soon hold trout if the judicious construction of dams here and there, was undertaken. Much the same applies to the Turner's Valley river, though this water is teeming with small fish. We are of the opinion that in connection with the rivers on Hamilton's Plateau, there is an absence of predatory life, and that little or no interference with the spawning beds other than possible spates from the N. E. Monsoon can be anticipated. From the number of trout seen at Poovar on the last inspection one might be led to believe that something like 25% of the eggs laid by wild fish here hatch out and come through to maturity.

Generally speaking, we have at Rajamallay the nearest thing to ideal conditions for Rainbows obtainable.

Turning for a moment to the other side of the picture, to Devicolam, a loch which has already proved its popularity, but which can hardly be called ideal water. Work must be undertaken here to speed up the flow of the feeder stream which can be done by the construction of a series of small dams. In making dams for a sluggish stream such as this, it should be remembered that three one-foot dams are of more use than one of say four feet. The more aeration the better, particularly where temperatures are inclined to be high. Next comes the 'Problem of Mud' which may also be called the 'Anglers' Nightmare'. Mud may be composed of mineral matter such as sand, clay, and mica. This is probably harmless, but the black mud of Chittavurrai, and parts of Devicolam, which is made up of rotting vegetation and plant life, is dangerous and sometimes fatal, and when it is stirred up gives off a most unpleasant sulphurous smell. The centre of such heaps are lacking in oxygen, and foul smelling gases are formed. When the mud is exposed to the air or well aerated water, oxygen is used up very quickly and the sulphide gases are exceedingly poisonous to fish. It is therefore quite obvious that at Devicolam where the water already lacks aeration, steps should be taken to control mud to the maximum extent. In England, mud is sometimes controlled by a series of hurdle batteries. When sufficient mud collects behind the hurdles selective weeds are planted in it, and in this way the harmful properties of the mud are gradually dissipated.

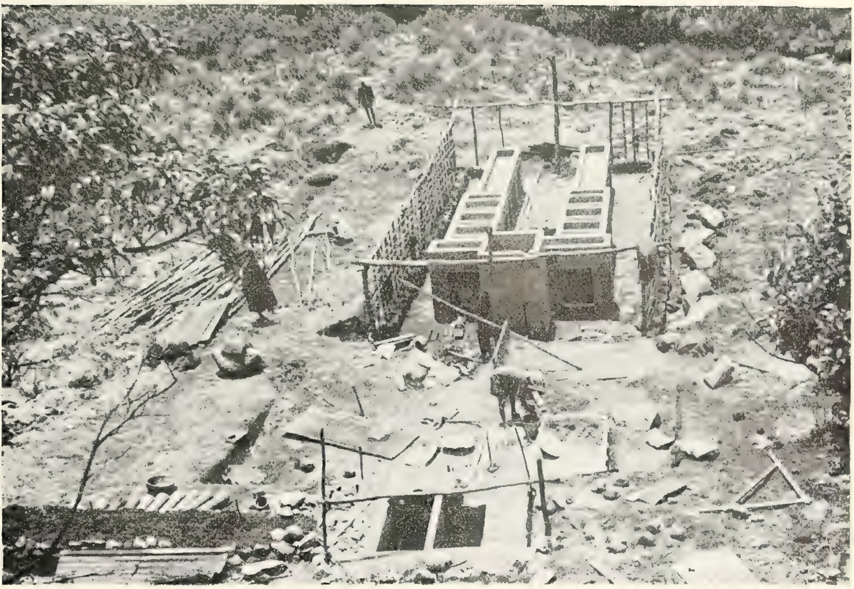
In cutting back reeds or overgrown weeds it should be unnecessary to mention that the cut stuff should on no account be thrown back into the water, but should be carefully collected and heaped on the bank for burning. Rotting vegetation soon uses up valuable oxygen supplies and that part of the water where it had been left might soon be rendered quite useless.

All these observations to some extent apply to the hatchery, but here the river and ponds are under constant supervision, and cleaning etc., is carried out under ordinary routine.

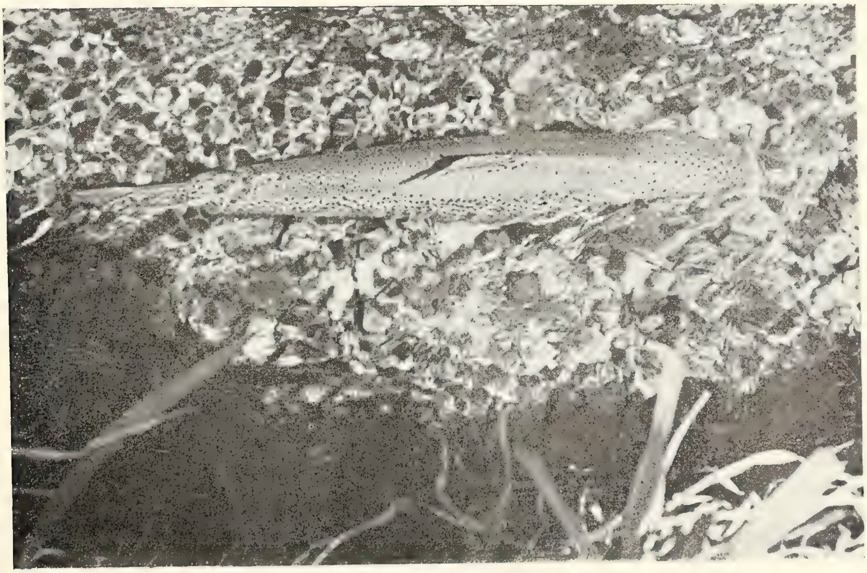
And now a word about otters. It is thought that the common Indian Otter (*Lutra Nair*) (Tamil, *Nir Nye*) is a much maligned animal. There is no doubt that he is a sporting 'jolly little dog' and we love nothing better than to watch him at play. At times however he can be a destructive pest and given the opportunity will kill fish by the hundred, far in excess of his own food requirements. We recently experienced most bitter examples of his capabilities in this direction. The run from the big pond at the hatchery was, until quite recently, unscreened, and there can be no doubt that these little robbers succeeded in getting away with several brace of fine three-year olds which had come up to spawn. On another occasion otters succeeded in getting into the 'stews' for yearlings, and took no less than 300 fine trout in one night. Wire mesh fences set into the ground to a depth of about one foot and sloped outwards, to 6′ above the ground have proved most satisfactory in keeping otters out of the stews. A wild spawner taken from the river in 1944 had its nose, and the side of the gills, torn away in a manner suggesting that it had been attacked by a cat. It was thought that this must have been the work of a wild cat or jackal. The latter feed freely on crabs, and a large trout coming into the shallows at night would prove an easy prey. The Brown Mongoose (*Herpestes fuscus*) should also be on the black list.

Hatchery improvement during the year 1942-43 consisted principally of the construction of a large pond for breeders. Water was diverted from the main stream into a natural ravine at the bottom of which a concrete dam was constructed. The water is exhausted over this dam into the river, below, about 100 yards from the intake. Surface water is also taken off by concrete boxes, each 18″ x 9″, which fit into one another, control the level of the water, and facilitate drainage when the pond is due to be cleaned out. Absolute control is of course necessary in constructing any sort of fish pond as otherwise it would be impossible to undertake cleaning efficiently. We have now at the hatchery, four stews, four grading tanks, and the large pond or 'stew' for breeders. For our own requirements this is ample accommodation, though of course trout should never be overcrowded. The figure given at home for two-year olds is one trout to one cubic yard. Out here at least five times that space should be allowed in our opinion.

From the new pond, spawners first began to come up the run in November 1943. Wild fish were showing signs of spawning about a month before that and up to the end of January. A small percentage of eggs from natural redds and wild spawners were taken. These eggs are usually much healthier in appearance and it is desirable to collect as many of them as possible. The trapping of wild spawners presented some difficulty owing to transport restrictions and pressure of other work on the Estate. Spawners were trapped in the main Rajamallay river and the Aneikad river which joins the former above the Swing Bridge pool. There are many perfect natural spawning beds in this area. Early each morning men are sent out to look for fish, and as soon as these are discovered on the redds suitable lengths of wire mesh of the kind generally used for withering green leaf in the tea factories, are stretched across the river above and below the runs. These improvised fences are quickly clamped down with stones and supported with stakes. The spawners are then netted and stripped on the spot, the ova being taken up to the hatchery in a galvanised pail. It is an interesting provision



Rajamallay Hatchery under construction.



A trout coming up the spawning run.

of nature that eggs will stand a certain amount of movement immediately after impregnation, and there is thus no difficulty in carrying them a distance of three or four miles, provided the sun is kept off them with a damp towel. A fine hen fish 24½″ in length was tailed under a bank and placed in one of these screened runs. She appeared to be a ripe fish but there was a hard spot round the vent and after a month she still showed no signs of laying.

We will conclude this chapter with the observations that while the eggs of wild fish appear in every way more desirable than those of pond fish, the cost of obtaining it is very considerably greater.

Also the eggs of wild fish seem to be more delicate, though it is not quite clear why this should be. The acid test is fertility and the colour of the eggs has nothing to do with it. Provided well shaped alevins hatch out then the rest is merely a matter of correct feeding and sanitation. The rich pink of eggs from some wild fish is a question of feeding entirely and shows that they have come from water rich in crustaceous food.

VII.—Transport, Stocking and River Management

Transport.—Tιansport from the hatchery has been carried out to all parts of the Concession, mostly by cooly headload. Where possible, trout are taken in fish carriers by lorry. This can easily be done where roads lead to the water, but transport to Eruvikulam and the Sambumallay river is undertaken in half a day by headload from the hatchery.

A big undertaking in connection with fish transport was completed successfully in 1942. This was the stocking of the Pooar river in the remote areas lying towards the Northern boundaries of the Company's Concession. This is a river notable for its beauty and fishing possibilities, and it has been the dream of many, interested in trout culture, to see it stocked. It has always been our policy to undertake headload transport in the height of the monsoon, it being argued that at such a time the danger of the water in the fish carriers overheating, or running out of oxygen, was minimised. Such expeditions, however, called for great hardship and endurance from the labour, and those in charge of the operations, so that it was decided that the Pooar project should be engaged upon in two stages, and in comparatively fine weather.

A stew pond was made at Eruvikulam, and on the first day the fry were successfully brought there without mishap, a distance of about 12 miles. Unfortunately the sides of the stew pond had been made flush with the bank, and only about 18″ above the level of the water. Consequently during the night a few fry succeeded in jumping out and wriggling their way into the grass, where they were found dead in the morning.

The carriers used for headload transport are ordinary earthenware jars made locally, and fitted with a perforated metal covering. They form the most excellent carriers and the water keeps remarkably cool, even at noon on a hot day.

On the second day of the transport the weather was so fine that we were able to film the whole proceeding from the start at dawn, to the actual liberation of the fish. This half of the journey, over a distance of eight miles, was a difficult undertaking on account of the percipitous nature of the country and the absence of any sort of path other than the rough game tracks, a network of which are to be found everywhere on the grass hills. The expedition arrived shortly after noon and it was found that the temperature of the water in the river was 4 degrees below that of the water in the carriers. The process of liberating the fish had therefore to be carried out with great care and two hours were occupied in bringing the temperatures together, by the gradual application of river water.

In stocking a virgin river the correct procedure is to commence as near the source as possible, and to dibble the trout out in families of seven or so, at intervals, downstream. Hatchery bred fry tend to keep together in swarms and if this is not done they become an easy prey for their natural enemies. Although the work was carried out very carefully, fry were actually seen in the river well over a mile below the point where the last had been liberated, on the same evening, thus showing at what rate they will move off down stream.

It should have been mentioned that an experimental transport of 100 fry had been undertaken some months previously, in February 1942. The fish of this stocking were seen rising freely down the river, and in 1943 a number were caught weighing 2 lbs. What was still more gratifying, however, was that their sons and daughters were seen in numbers in May 1943, thus proving another stream to be successful, from the breeding point of view. In 1944 a stream in British India 35 miles from the Hatchery was successfully stocked with Rajamallay yearlings.

We have studied in the foregoing a brief history of the introduction of trout of Travancore, and something of the lessons learnt in the hatching and transport of these fish. Let us now turn to a study of the fish itself, and, later, to a very important item, the question of *overstocking*.

The first trout tried out in Travancore was the Brown Trout (*Salmo fario*) which is indigenous to Scotland, and nowhere excelled for beauty and sport, unless by its first cousin the Loch Leven Trout (*Salmo levinensis*) believed by many to be the same fish. It was discovered that though these trout had all the apparent qualifications for success in our waters, they would not stand such a high range of temperature as we experience here. In consequence breeding was upset, the sexes never being in season at the same time. The Rainbow Trout successful in Ceylon and the Nilgiris was next introduced with undoubted success, but let us try to study the actual degree of success obtained, and probable difficulties of the future.

The Migratory Instinct.—We came into close contact with the Rainbow Trout only after coming to the East, and for what little knowledge we now possess we are indebted to Mr. Fowke of Ceylon who appears to have arrived at the answers to the most of the problems. Mr. Wilson H. Armistead in his book 'Trout Waters' refers to the introduction of Rainbow Trout from America, in 1900, to the British Isles, while in 'Fish Farming for Pleasure and Profit', Rainbow Trout (*Salmo irideus*) are referred to as being native of the country extending from California near the Mexican Boundary to Southern Alaska. Mr. Fowke states that the pure Rainbow (*Salmo shasta*) is a river fish, whereas *Salmo irideus* which should properly be called the Steelhead, is anadromous, that is to say, it lives in the sea like a salmon, and has to come to fresh water to spawn. The two varieties are so alike that it is only by careful scale counting and vertebrae counting, that they can be accurately distinguished. Our trout are a cross between the two and the resultant fry in which the Steelhead predominates, will make for the sea at a certain age, while those in which the Rainbow predominates, are left behind. Trout have been caught in our waters which in some respects resemble the Scottish Brown Trout. Is some interesting change taking place due to our local conditions? The theory that cross breeding with Brown Trout had taken place previously either in the Nilgiris or in Ceylon does not seem to have any foundation.

In Travancore the artificial ponds, holding only muddy water and with no proper inlet stream, were a failure. Here the trout put on tremendous weight in the first two years, disappeared, or died in the mud. *Loch Finlay* a splendid sheet of water, but lacking aeration and a feeder stream, was a partial success only; the trout seemed to do quite well in the first and second years, and then disappeared. Here also it was thought that trout had developed one of these strange diseases to which Rainbows placed in stagnant water are prone. The *Devicolam Loch* had proved a 90 per cent success but required restocking every second year. The Loch is fed by a good stream and weed and shade is plentiful. Rainbows require plenty of food and plenty of shade to be successful, and Devicolam has both assets. Lack of shade might cause ophthalmic trouble, a point sometimes overlooked. *Eruvikulam*, 7158′ above sea level had proved a great success and natural breeding took place from the very first. The original trout grew to a tremendous size, some close on five pounds having been caught. Most of these disappeared in the third year and in company with many other trout went down over the falls into Turner's Valley, a drop of 1000′. That trout have actually reached the Lower Vagavurrai Estate, an elevation of 4540′ is an established fact, and from that, it is safe to assume that many have reached the borders of Travancore, an elevation of 1480′.

A trout can adapt its temperature to that of the water it travels through, and Mr. Fowke has successfully moved trout in Ceylon from a temperature of 56° to 83°.

The question of what happens to our trout when they leave our highland areas is a contentious one, and a subject upon which none of us are at the moment in a position to debate. The natural breeding at Eruvikulam has been augmented with fry from the Rajamallay Hatchery, with the result that the head waters have now been so overstocked that the pound trout is the exception rather than the rule. As a result, further stocking has been postponed meantime, but it is a great pity that the larders were not more sparingly used, and thus a higher weight average maintained for a little longer. The waters here lack shade, but this is being planted up gradually. The *Turner's Valley* stream stocks itself from Eruvikulam, but trout tend to congregate here either at the top, near the falls, or at the bottom, where the river enters the forest. This is because good deep pools with shade and shelter for the dry weather months are not available in the intermediate stretch. Much river work such as the construction of stone dams and deflectors to create good holding water throughout the whole valley remains to be done. The First Turner's Valley trout was caught by Mr. E. H. Francis on 27th October 1941, weighed 1lb.

The *Sambumallay River* which is within 20 minutes' walk of the Eruvikulam camp is a small river containing a few pools at the bottom. It is excellent water in which small trout are thriving. The river at *Kanniamallay* is holding trout. The head waters of this stream come through the tea for about two miles and the river is subject to spates of dirty water. It is very doubtful if natural spawning will take place. The *Rajamallay River* contains several miles of splendid water, with deep pools and cataracts, very reminiscent of the highland streams of Scotland. So far it seems that trout are going to do well there. The water was first stocked with a few trout in 1941 and these were liberated on the slopes of Aneimudi. The summit of Aneimudi is 8840′ above sea level, and the trout were probably put out at 7500′. These worked downstream but not quite so rapidly as in other rivers. In March 1943 a hen fish which had died spawn bound, was taken from the river some three miles below. *It weighed 8 lbs. and was 25″ in length* ! This is another example of what can happen when a few of these trout are liberated in such well stocked larders as our Highland streams in Travancore. But let us beware of using up these valuable larders indiscriminately. Rather let us see to it that we preserve them and where possible increase them. Let us preserve our trees and shrubs, on the river banks, and where there is no shade let our motto be PLANT, PLANT, PLANT. The penalty for cutting trees should be death! Clumps of Black Wattle are being encouraged, and also *Hakea saligna* (The Needlewood tree of Queensland), but it is difficult to find a suitable tree which will thrive under such inclement weather conditions as exist in the monsoon months. However the work MUST go on from year to year, or many of our present gains may be lost. Aquatic plants (Watercress) (*Nasturtium officiale*) and grasses have been successfully brought from Chittavurrai and Devicolam and established in ponds at the hatchery. The Rajamallay river in common with most of our best water rises close to Hamilton's Plateau, which is the principle water shed in these hills. It is, however, subject to even greater spates than probably elsewhere, on account of the fact that the South West face of Aneimudi upon which it rises, receives the full blast of every monsoon burst. The average rainfall, taken a few miles below the hatchery, amounts to no less than 315 inches over the last ten years, and on 13th July 1943, 22″ of rain was measured between the hours of 6 p.m. and 8 a.m. It is therefore useless to attempt planting weeds by artificial means in the main streams under such conditions. The answer is to make experiments in side streams and ponds not subject to serious floods.

About three miles below the hatchery, the river flattens out into a swamp which has recently as 1926 was the home of Elephants and Bison, and a place well known to 'Shikaris'. Silt from the clearings has turned most of this swamp into a sand bank through which the river flows at an almost imperceptible pace. At the corners of the river there are several exceedingly deep pools overhung with jungle trees, and in these, many trout averaging not less than two pounds have been located. Their age cannot be greater than three years, and we are convinced that several of them are over 5 pounds in weight, judging from the one already referred to as having been found spawnbound. Below the swamp the river falls away into rapids and great pools overhung by rocks. The man who has the luck to hook one of these monsters in such heavy water will have an experience worth remembering.

Since writing the above, several trout were caught at night on a fly resembling a Peter Ross, but with a woodcock wing. Their weights were from 2 to 5 lbs. 12 oz. The stomach of one trout of 2 lbs. was crammed full of recently devoured and quite undigested fresh water shrimps, 87 of them, no less. The voracious habits of the Rainbow are truly remarkable. Once again we say, for indeed it can never be too often said, 'BEWARE OF OVERSTOCKING', and explore all methods of food conservation.

The importation of the eyed ova of the pure American Rainbow Trout (*Salmo shasta*) and Brown Trout (*Salmo fario*) has been advocated. This might be done but the writer can see no advantage in such an undertaking, or in what direction the fishing would be improved. Our hybrid trout which can never return from the Sea if they ever reach it, and which can therefore safely be called Rainbow, are hardy, sporting, and prolific, and seem well suited to our water. What more can be wanted?

The growth rate of trout is governed solely by the amount of feed available, so that in the hatchery it is possible to tell the exact amount of food required to grow a pound of flesh. We have already seen what our trout can do when liberated in such virgin waters as Eruvikulam and Poovar. We have also seen, alas, how quickly food stocks deteriorate and how quickly the weight average falls. Our future policy must centre round two very important points. These are:—(*a*) conserve and increase the food content of our streams and (*b*) keep a sound balance between food and stock, by increasing limits, or netting, where water has already been overstocked.

Since writing the foregoing the question why big trout die spawnbound has been asked. Unless trout have suitable conditions they lose the incentive to spawn, though the ova continues to develop until eventually the mass so formed presses against the pericardium and heart causing death. Trout must have low temperatures and range with access to shallow evenly running water flowing over gravel and small stones. Semi-stagnant or muddy conditions upsets metabolism particularly in the case of these fish which, as has already been explained, are to a great extent migratory.

The broad principles of Trout Stream improvement as they apply to the High Range were dealt with in a supplement to the General Report for the season 1944-45. In this work great stress was laid upon the necessity for making the best use of natural food reservoirs. Ditches and side streams can by judicious management be made to maintain large stocks of many fresh water animals. Shrimps (*Gammerus pulex*) will breed freely all the year round and their introduction to almost any class of water is no very difficult matter. In conjunction with shrimps, snails (*Paludomus stomatodon*) which are very prolific in our waters, can be introduced. Often old game wallows or hollows below the level of the main stream can be turned into excellent food farms by diverting water through a channel and controlling the level and the pace of the water through the artificial pond so formed, by means of sluice gates. In such ponds vast supplies of the natural food of trout can be built up and maintained, and from time to time a proportion of this can be induced to make for the main stream by opening up the gates. Any such work on food conservation is absolutely invaluable.

VIII.—Some Fishing Incidents

This work will, I am told, be incomplete without some reference to fishing itself. So many factors of wind and weather, and other conditions, come into the question, that when I am asked what are the best flies to use on our rivers I am unable to give an answer. The ancient 'Book of St. Albans' mentions twelve flies. The 'Dunfly', body of dun wool and the wings of the partridge would appear to be the oldest and most popular. The best known after the 'Duns' are the 'March Browns' and the 'Greenwell's Glory,' and on most brown trout streams at home these take as big baskets as any other fly. A long list of new-fangled flies has crept in. The list is so long in fact that one's brain reels on attempting to memorise it. A great many are mere 'catch pennies', for nothing looks more attractive and alluring than a host of flies neatly set out in the tackle expert's shop. Many trout are taken on small salmon flies, and such new inventions, with silver bodies, as the 'Butcher' and 'Peter Ross' which are really lures. In some respects the capture of fish with them is tantamount to spinning, as they suggest the small fry of indigenous fish found in most waters, but certainly the bigger trout are often caught that way, which is a very good thing indeed. It has been stated that the Rainbow Trout is easier to catch than his cousin *Salmo fario,* and at certain times of the year this is undoubtedly true. The Rainbow Trout often accepts a big variety of flies under similar fishing conditions. In my experience the never-failing fly or lure contains red, with either a teal or woodcock wing, but when the water is heavy the silver body is very deadly. For the late evening a black fly with a silver twist, red hackle, and jungle cock wing such as Watson's Fancy does good work, and late at night the Teal and Silver. Rainbow trout when they are on the feed are much less 'gut shy' than the Brown, and if anything the splash of a badly cast fly seems to attract them. It is necessary, however, under almost all conditions, to keep well out of sight. I know of a pool on one of our rivers where big trout lie. The head of the pool contains many rocks and boulders affording the most magnificent sanctuary for wary trout. The 'hing' or end of the pool is full of gravel and sand, and the big trout if undisturbed, will lie there throughout most of the sunny part of the day. I always found great difficulty in approaching this pool and on each occasion managed somehow to give myself away. At last I discovered an infalliable line of approach, some trick of the light, or the particular location of the pool, making all others impossible. Having got into position I began very carefully to look from behind the 'hide out', and soon discovered two of the trout lying in their favourite spot. When a light breeze sprang up I cast and immediately hooked one of the fish which on being netted was found to weigh two pounds. When big wary trout are lying in clear water they can be caught if patience, combined with careful observations, are applied.

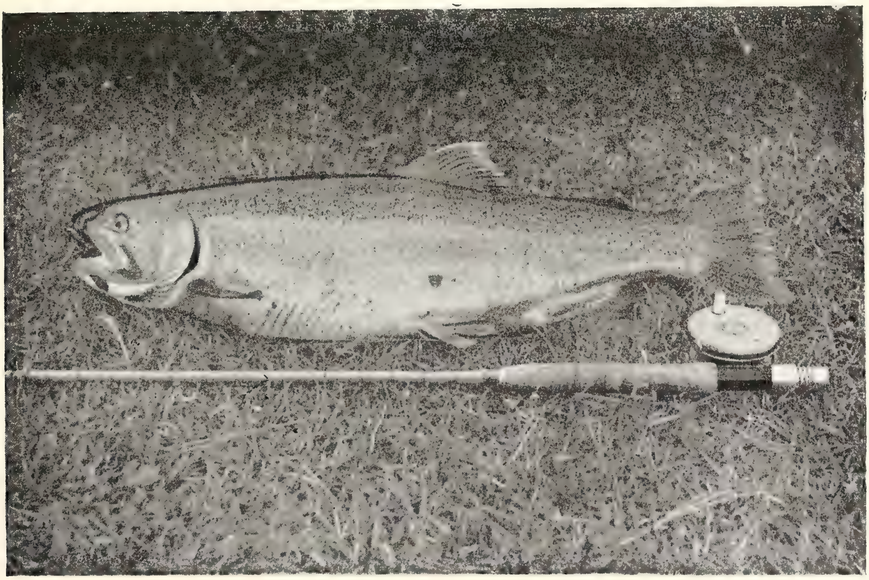
At nearly all times of the year the floating fly will do well on Upper Eruvikulam and most of the Pooar river. One year the fishing in April and May fell off very badly and for a month no records were sent in except those of a keen dry fly fisherman who consistently collected 2 or 3 brace of trout, particularly on windy days.

The waters of the High Range will in time, all provide sport of the very finest, but the cost of the success to date has been heavy, and the Company and their employees have borne the whole expense themselves. It is therefore no wonder that so far the waters which are private, are seldom open to visitors, though occasionally a guest of the Company is granted permission for a day on one or other of the streams or lochs.

The following is an extract from the author's Fishing Record Book:—'The Eruvikulam River falls into Turner's Valley and then winds its way through grassland and jungle, eastwards and then North eastwards towards the plains and the Coleroon which it ultimately joins. After leaving Turner's Valley it falls away sharply in a series of great falls and cascades towards Luckham and the Lower Vagavurrai Tea Estate, where there is a famous pool called the Luckham pool. In February 1944 an old planter who has been connected with sport in these hills for many years, reported trout in this water. The elevation is about 4,100′ above sea level here, but as the water pours straight off the high hill temperatures probably do not exceed 65° at the hottest time of the year. All the water from this point downwards for some miles, is in every respect ideal, although it is very unlikely that trout will breed successfully in it. On the night of 29th February 1944, I went with this planter down to the pool to try a cast or two. Towards 7 o'clock a big trout came into the shallows at the mouth of the pool together with three or four smaller ones. In crossing the river however. I fell and smashed the point of my rod just above the last rung but one, This made further fishing exceedingly difficult, for with each cast the line whipped itself round the broken end of the top joint. But for the moment the big trout had disappeared into the black depths of the pool. The light was going fast when its shadowy form appeared again in the shallows, and several casts were made over it with a large fly, "a grouse and claret". Suddenly when hope had been given up, the fish took the fly with a tremendous splash and was off like an express train into the centre of the pool, but I fortunately had the presence of mind to lower the point of my rod after striking, thus freeing the line. The fish rolled several times like a salmon, and then came back to the shallows, but after the initial rush it gave little trouble, although with the anxiety of the broken rod and the thought that it was very lightly hooked and the cast frayed the final outcome was in doubt up to the last moment when it was netted successfully. It was immediately taken up to the Factory and accurately weighed there at 7 lbs. 2 ozs. It was 24¾″ in length and had a girth of 15¼″. It was a hen full of almost mature ova which weighed a pound and a half. The stomach was quite empty arguing that it was a late fish in season and about to spawn. I was of the opinion that it was not spawnbound and that it would have got rid of the eggs within a few weeks. This is the largest trout to be taken on the rod in Travancore, and I have not so far heard of anything bigger in the Nilgiris, though no doubt such fish must have been caught there in the early stages. Trout when they come into season do not feed readily and in many cases probably do not feed at all. A trout in this condition is however either annoyed into taking a fly by its frequent appearance adjacent to a favourite lie, or because the fly represents some insect dangerous to the spawning beds. Mr. Philip Fowke wrote on the 11th March 1944 that this fish broke his long standing record for Ceylon of 6 lbs. 12 ozs.'

Big Trout.—Other notable trout have already been referred to the biggest of these being the eight-pounder found lying dead in Rajamallay river in 1943. Mr. E. H. Francis caught fish of 4¼ lbs. to 4¾ lbs. on several occasions. The visit of Major-General (now Lieut.-General) E. F. Norton, C.B., D.S.O., M.C., in 1939 when six trout were caught weighing 20 lbs. has also been

Transport of trout fry over the grass hills.



Record trout for South India—7 lbs. 2 oz.

referred to. The biggest in that basket was caught by the General on a dry fly and weighed 4½ lbs. One of the biggest trout recorded previously, came from the Chittavurrai Lake. It was 5½ lbs. and was caught by Philip Gouldsbury who was also connected with the early efforts to establish Brown Trout.

Exciting incidents make more pleasant reading than a mere list of records and we will try to glance through the Association's Game Book and recall a few of these. The description of the catching of the first Rainbow Trout at Eruvikulam has already been given. This should have been a signal for the opening of the river to fishing, in the opinion of many, for in the spawning months that followed none of these monsters were seen again. Many of them succeeded in negotiating the 1000′ falls in the monsoon and getting into Turner's Valley, where in September 1942 the most perfect specimen of a Rainbow Trout so far seen was caught by Mr. Francis. On that occasion I had received instuctions to meet Mr. Francis at a point half-way between the High Range and the Anamallais, the next range of hills, from whence he was walking on an inspection of concession land. It was a longish trek taking in all three days, and on arrival in Turner's Valley on the homeward journey it was about 12 noon, with time enough for a few hours' fishing before proceeding to the last camp. The sky was cloudless and the water clear as gin, but it was decided to try a few casts in the runs towards the end of the valley. At the second or third cast a heavy trout was hooked on a 'teal and silver'. After the first rush the fish bored back into rough water and at such speed that for a time there was several yards of slack in hand. However after a splendid fight the net was slipped under him and a fine trout of 3¾ lbs. was brought to the bank. That was the only trout seen that day but one well worth and even longer trek. Those who are known to have caught trout over four pounds, are only seven in number and as these monster trout will always be few and far between, a note of their names will be of interest.

W. S. S. Mackay from the Luckham Pool ...	7 lbs. 2 ozs. length 24¾″.
Philip Gouldsbury at Chittavurrai	5½ lbs.
E. H. Francis at Eruvikulam and Turner's Valley.	2 @ 4¾ and 1 @ 4½ lbs.
Mrs. W. S. S. Mackay at Chittavurrai ...	4½ lbs.
Lieut.-General E. F. Norton at Eruvikulam ...	4½ lbs.
W. S. S. Mackay at Eruvikulam	2 @ 4¾ and 1 @ 4 lbs.
Alasdair Steven at Rajamallay	4½ lbs.
W. S. S. Mackay at Rajamallay	5¾ lbs.

It is thought probable that J. S. B. Wallace and J. M. Bridgeman caught trout over 4 lbs. but these were not recorded by the Association.

John Hamilton Wilkes did a great deal of work in connection with stocking the rivers. How he caught his first trout, and gave the name 'Hamilton's Hole' to the Big pool at the bottom of Turner's Valley makes a story worth recording. He had been fishing for some hours without result, when he felt a steady pull on a large salmon fly which he was drawing across the river at a depth of several feet. With a yell he announced that he was into a fish, that his reel had jammed, and his line became entangled. It will never be quite known how he accomplished it, but without the aid of a free running reel, he succeeded in bringing to the bank a fish weighing 3¾ lbs. which in contrast to the one just mentioned, was one of the ugliest-looking cannibals yet seen in our waters. The fish, a male, had a more than usually pronounced hooked jaw, and was almost yellow in colour, with a deep red line. It took 25 minutes to land but fortunately never made a run out of the pool.

At Devicolam some very big baskets have been recorded. One day in June 1943, 29 trout weighing 29 lbs. 15 oz. were taken, by four rods.

In 6 days' fishing on Hamilton's Plateau two planters from Burma took 75 trout weighing 44 lbs. 12 oz. In March 1945 two rods took 87 trout under the ½ lb. average, in 6 hours' fishing at Pooar. There is no doubt that when the war is over and those on service return, some even bigger baskets will be recorded. The most killing fly on most occasions seems to have been the 'teal and red' but owing to the difficulty in obtaning proper gut most fishermen handicap themselves by using stuff which is far too thick.

IX.—Further Fishing Incidents

'Let us not burden our remembrance
With a heaviness that's gone'—Shakespeare.

Trout lost.—It is a pity that there is no means of recording the stories of trout hooked and lost. Fishermen are generally a trifle reticent on the subject of lost monsters, and I think that as a general rule the lost one seems, in the mind of the fishermen, gigantic, in comparison to those successfully brought to the net. Perhaps the biggest fish ever played for any length of time and finally lost by a piece of ill luck, was at Eruvikulam, when in 1942 the then Chairman of the Association, Mr. H. A. Ragg, was fishing the stretch in the upper waters, from the junction pool, towards the falls. The previous evening a tackle box had been lost, and early in the morning he had gone out unaccompanied, to make a search for it. The box was soon found and he put up his rod to have a cast or two before returning to breakfast. He had no net, but was not unduly worried as no big fish had been reported in this water for some months. At the second or third cast, however, he rose and hooked one of the monsters, no doubt a member of the original batch put in during 1937. There was no use shouting as the camp was too far away for the sound to carry, and it would only have been by a stroke of luck if he had been spotted by one of the watchers. The rod that he was using was a short light affair with which it would have been difficult enough to control a heavy trout in any case, but nevertheless at the end of twenty minutes he had the fish below him, more or less on its side, and ready for the net. From his position it was apparently quite impossible to tail the fish, but there was a weedy bank a little lower down on which he attempted to beach it. The fish was probably 6 lbs. in weight, but alas it never reached the camp to be correctly weighed. In the effort of trying to beach it, the cast broke close to the fly and slowly the fish recovered itself and swam off into the deeper water beyond.

There have indeed been some very large trout lost at Eruvikulam, and in 1941 Major J. R. S. Mackay hooked one on a small Dyson opposite the Rhododendrons about half-way down the same stretch. The fish took the fly close into the bank and the Major saw it clearly before it made the first rush. He thought that the trout was bigger than any he had caught in many years of fishing, and it certainly fought like an exceptionally heavy one for some seven or eight minutes. By an incredible stroke of ill fortune the knot at the fly slipped and the fish got away.

Though the weight of these lost fish can never be known, it is safe to assume that there are many trout within our concession of 5 lbs. and over and by concentrated night fishing a few of these could no doubt be taken on the fly. Using a teal and silver and perhaps with the help of a maggot or two, big trout can often be persuaded to move. During daytime and late evening they are wary and keep to deep pools and cover.

In 1944 some complaints were heard regarding the falling off in weight averages. These mostly came from fishermen suffering from a 'big fish complex.' Having caught the monster trout which grew in the lakes and rivers in the first year or two after stocking, disappointment was felt when baskets containing only half pounders were the order of the day. As has already been explained trout put on great weights when liberated in virgin water, but the average eventually falls to a standard in direct ratio to the class of water.

If big weight averages are to be obtained trout must have tremendous range with access to and from big water. In the High Range our streams are torrential and there is little or no catchment area between us and the plains. On the West the waters fall in one mighty drop to the plains and the coast of Malabar, while on the East they are broken up by a series of falls and cascades which no fish could ascend. It follows therefore that we can hope to breed only a race of hardy hill trout and if baskets average out at 8 ozs., what more can be expected? With proper river management this might possibly be improved upon, and undoubtedly there will always be the chance of a big one on some of our water. Indeed there are more of these trout about that is properly realised. There are many jungle pools fed by broad stretches of shallow rough water and in the late evening big trout are to be found in these runs.

It is interesting to note that on Hamilton's Plateau there are two rivers within a few minutes' walk of one another which are frequently fished on the same morning. The water from the first flows east and eventually joins the Cauvery and the Coleroon, while that of the other flows west, and joins the Periyar and the sea near Cochin.

The best and most exciting time for fishing in the High Range is probably just as the South West Monsoon rains begin to abate—that it, if the fishermen are prepared to stick the leeches which on most of our rivers are so bad that for some people the whole joy of the day is lost. Those who are allergic to leeches should avoid the High Range !

There was a break in the weather towards the end of last monsoon and for three whole days the sun shone. On the last day I woke up to the fact that I should be fishing, and sent men down to a favourite beat some miles below the cultivation on the Rajamallay river to light fires and keep a look out for these pestilential elephants. Here there is a fine deep pool of about two acres in extent, fed by a broad stretch of rough rocky but shallow water—a place such as big trout love in the late evening.

The light had almost gone when fishing began above the Pool in the rough water. At the third or fourth cast a pound trout took the bob fly and fought so well that the next fifteen yards or so of water was hopelessly disturbed. Shortly afterwards there was another rise to the bob fly but thereafter nothing, and the impression was that the best of a good late evening rise had been missed. At the tail of the run however the steady pool of a heavy fish was felt and a big trout took the tail fly, a teal and silver, quite quietly, as does a salmon very frequently. Steadily upstream cruised this large trout and presently its dorsal fin was right out of the water and the back of a real 'whopper' displayed itself. As the fish came directly opposite it suddenly seemed to realise that all was not well, for it turned in a flash and was off downstream, and clean across the jungle pool in one glorious rush. Here I made the great mistake of trying to stop it and the line went slack. The cast had held alright, but the line of all things had broken, and then only I realised that lines cannot be expected to last indefinitely even with the greatest care, and that the one in use was seven years old ! But that great rush will live in the memory. Indeed it is the stories of these mighty lost ones that live for ever.

An Experience.—A point has now been reached in the story of our High Range Trout Culture, from where it is impossibe to proceed further. Most of the work now being undertaken centres round important hatchery improvement, *river improvement*, and general observations. In two years' time perhaps, another instalment may be forthcoming and I look forward with hope to writing of success, in a world free from war and misery. In looking over the pages of this report, for it is thus the work should be described, I wondered how many would be really interested in it? It has often been said that fishermen are 'Lunatics' who are born not bred. To some extent that may be true, but I know men who have taken to fishing for the solace and peace of mind a day on the river gives them, for the beautiful places it takes them to, and for the wild bird and animal life they see. To illustrate this point I will record a story. A few days before departing on two months' local leave, a planter left his Estate to walk over to Sambumallay and Eruvikulam, to have a look at the waters, and to see how things were getting on. It was a clear morning but with wisps of mist floating on the summit of Aneimudi, and as he marched along, he felt he didn't want to go on leave at all, and that all he wanted was to be left alone, to wander about these beautiful hills for the rest of his life. Written up in his shikar diary is a short list of the game he saw that day. On the Vagavurrai rock a fine saddleback, at Neelakal a sounder of pig, at the Junction Pool of Eruvikulam a jungle sheep, on Sambumallay, a herd of 50 Ibex, at the head of Turner's Valley a fine Bull and four cow Bison, at the bottom of Turner's Valley two sambhur hinds, and on the Luckatavurrai another herd of Ibex. It may indeed seem like a romance, but on the same day he saw a spotted panther in the distance. He knew there was a big trout in a pool in the river and his choice was between the panther and the trout. He chose the trout and got him too, and it weighed 4½ lbs ! Such days may be exceptional but they are there for all of us.

Conclusion.—Nearly all the resident planters in the High Range and many of the ladies have at one time or another subscribed to the work of the Angling Association, and it would be quite impossible to mention the names of all of them individually. This work cannot however be finally closed without one further reference to the first Chairman of the present Association, A. W. John, who first introduced the Rainbow, and the Secretary, John Muir, J. S. B. Wallace, E. H. Francis, General Managers of the Kanan Devan Hills Produce Company Limited, and Alasdair Steven. These gentlemen revived the experiment in 1932, and stuck to it through its many adversities, and it is to them that the thanks of all the young men who will return from the war and who will enjoy happy days on the lochs and rivers will be due. Those who were left behind to carry on in the High Range during the second Great War, undertook the work of hatching trout and stocking the waters with the additional satisfaction of knowing that they were doing something that would give pleasure to the boys who have been fighting for them in Burma, the Middle East and elsewhere. If when these return they find amongst the hills and upon the rivers that tranquillity for which they must have so often craved, the debt, if such exists, will have been more than fully repaid.

PROGRESSIVE DESICCATION OF NORTHERN INDIA IN HISTORICAL TIMES.

BY

M. S. Randhawa, M.SC., I.C.S., F.N.I.

(*With one plate and 2 maps.*)

During his studies of the beautiful trees of ancient India the present author came across some interesting evidence, archaeological as well as literary which sheds light on the climate of northern India from *Circa* 500 B.C. to *C.* 640 A.D. Most of this evidence is from Mathura region and is based on the study of numerous sculptures recovered from time to time from that district due to the efforts of pioneers like Mr. F. S. Growse, Pt. Radha Kishen, Dr. Fuhrer and others, and now housed in the archaeological museums at Lucknow and Mathura. It shows that about 2,000 years ago the 'Brij' districts which today have a desert vegetation were covered with wet tropical forests containing evergreen trees of Indo-Malayan affinities which flourish at present in Assam, Bengal, Burma, and west coast of India

This evidence is in conformity with that obtained from the observations of Douglas and Ellsworth Huntington on the annual rings of Sequoia trees of South-western United States. This evidence shows that a very wet period prevailed from *C.* 100 B.C. to *C.* 100 A.D. and since then the curve of humidity has a downward trend on the whole with only brief interludes of wetness. Since then aridity has been on the increase though it cannot be said with certainty whether it is due to shifting of climatic zones or due to other causes. Writings of Herodotus show that Western Asia was very wet between 400-500 B.C. The presence of animals of the swamps like elephants and rhinoceros in Sind and the Western Punjab is proved from the seals recovered from Mohenjo-Daro and Harappa which date from *C.* 3250 B.C. to *C.* 2750 B.C. Sind and Western Punjab are practically deserts now, though the evidence from the presence of these denizens of swamps in these regions points towards considerable wetness if we bear the present distribution of elephant and rhinoceros in mind.

Mathura Sculptures of Woman and Tree Design.

In excavations carried out at the ancient site of Kankali Tila, about half a mile to the west of the present city of Mathura from 1888-91 A.D. Dr. Fuhrer discovered the remains of a Jaina monastery which proved to be a veritable mine of beautiful sculptures. Many exquisitely carved bracket figures of Woman and Tree (*Salabhanjika*) design were discovered. The sculptors of these figures used spotted red sandstone, similar to that found in the quarries of Tantpore and Fatehpore Sikri in Agra district for carving these figures. Chronologically these 'Woman and Tree' bracket figures have been ascribed to the Kushana period, from I A.D. to 170 A.D.

These bracket figures were described by Vincent Smith[14] in 1901 in a valuable iconographic monograph, but he did not identify any of the trees. It is for the first time that we find Asoka and Kadamba trees mentioned by name in the catalogue of the Mathura Museum compiled by Dr. Vogel[7] in 1910. The remaining two trees have not been identified so far.

A close examination of Mathura sculptures reveals that leaves and flowers of Asoka (*Saraca indica*) was a popular motif of their decorative designs along with flowers and leaves of the lotus. While the elephant, horse, lion, and the antelope were their favourite animals, *Saraca indica* was their favourite tree. In the sculptures displayed in the Curzon Museum of Archaeology at Mathura and Provincial Museum, Lucknow, we find numerous sculptures in which Asoka tree is associated with male and female figures. In the Bacchanalian groups discovered from villages Maholi and Palikhera we find the drooping branches of Asoka with its unmistakable lanceolate leaves and also an inflorescence. On a slab with the figures of a couple feeding a parrot we find the blossoming branch of Asoka on the lower panel. On another fragment we see a squirrel climbing an Asoka tree. On a railing pillar we see a woman standing under a flowering Asoka tree.

Some of the Mathura sculptures displayed in the Provincial Museum, Lucknow, are still more interesting. In one of these we find a beautiful woman with a happy face standing cross-legged on a crouching dwarf, fastening a lotus garland on her head. Behind her we see an exquisitely carved branch of *Saraca indica* with its characteristic lanceolate leaves and ixora-like inflorescence (fig 2), which are so true to nature. In another we see a woman gathering Asoka flowers.

Apart from the Asoka, we find three other trees depicted in these sculptures. In one of these we see a woman under a Kadamba tree (*Anthocephalus indicus* Rich.) displaying a sword dance and touching its ball-like flowers (Fig. 1). The broad ovate leaves with conspicuously marked venation and globose inflorescences are prominent characters of *Anthocephalus indicus* which have been faithfully carved by the sculptor.

The third unidentified tree which we find appears to be Champak (*Michelia champaca* Linn.) and forms a background to a beautiful female figure wearing a peculiar head-dress (Fig. 4). The ovate-lanceolate leaves tapering to a long point, segments of the perianth in three series, oblong sepals and the stalked gynophore with numerous carpels, are characters of *Michelia champaca* Linn., a member of the family *Magnoliaceae*. The cone-like terminal structures appear to be the compound fruit of *Michelia champaca* rather than the flower.

The fourth tree with leaves like an Asoka and comparatively smaller axillary flowers, which we find in a sculpture behind the figure of a woman treading over a dwarf resembles *Mesua ferrea*

Note.—For Ref. Nos. quoted in the above text see page 565.

Linn. (Fig. 3) the well-known Nagkesar tree of Eastern Bengal, Assam and Burma. Its linear-lanceolate acuminate drooping opposite leaves with short peduncles and axillary solitary flowers resemble those of *Mesua ferrea* rather than of any other Indian tree. *Mesua ferrea* with its strikingly beautiful leaves and highly fragrant flowers must have been as popular in ancient India, as it is now in Eastern Bengal and Assam.

The accurate delineation of the foliage and flowers of these four trees, *Saraca indica* Linn., *Mesua ferrea* Linn., *Michelia champaca* Linn., and *Anthocephalus indicus* Rich. suggests that these trees were familiar to the Kushana sculptors from personal observation.

PRESENT RESTRICTED DISTRIBUTION OF *Saraca indica* LINN. AND OTHER KUSHANA TREES.

At present *Saraca indica* Linn. has a much more restricted distribution. According to Hooker[9] it is found only in the evergreen forests of the west coast of Bombay, Northern Circars, Khassia Hills, Chittagong, Upper Burma, Arakan, Tennaserim, Ceylon, Andamans, Malaya and lower elevations of Himalayas from Kumaon eastwards. (Map II).

As regards the present distribution of *Michelia champaca* Linn. Hooker[3] mentions: 'It is found wild in the forests of the temperate Himalayas from Nepal eastward, Nilgiris, Travancore, Pegu, Tennaserim, Malaya and Java. Haines[8] mentions Western Ghats, Singhbhum, Palamau, Neterhat and Mayurbhanj in Bihar in addition to the places mentioned by Hooker, and also states that at other places it is cultivated.

Anthocephalus indicus Rich. is found in natural condition in North and East Bengal, Western Peninsula, Ceylon, Andamans, Pegu, Malaya, Sumatra, and Borneo, and elsewhere it is cultivated. It is absent from the dry areas of the United Provinces, Delhi and the Punjab. Even in comparatively wet districts of Oudh it is rarely found cultivated in gardens, and if you inquire from people you will find very few who have seen a Kadamba tree, except in the mythological pictures of Krishna. The fourth tree which appears to be *Mesua ferrea* Linn.—the Nagkesar tree is found in Eastern and Northern Bengal, Assam, Eastern Himalayas, North Behar, Orissa, Western Ghats, Burma and Andaman Islands. Elsewhere in India it is cultivated only.

From the above it is apparent that the present distribution of these four trees is almost co-terminous, and the distribution of *Michelia champaca, Mesua ferrea* Linn. and *Anthocephalus indicus* Rich. falls in the line with that of *Saraca indica* Linn. A glance at the rainfall map of India, and neighbouring countries shows that these trees are found in the evergreen forests of India, Burma, Ceylon, Malaya and Sumatra with a rainfall of over 80 inches, and particularly *Saraca indica, Mesua ferrea* and *Michelia champaca* (Map II). *Saraca indica* is the most moisture loving of all these four trees, and then *Michelia champaca* followed by *Mesua ferrea* and last of all *Anthocephalus indicus* which can be cultivated in comparatively dry areas. Even in districts of Oudh with a

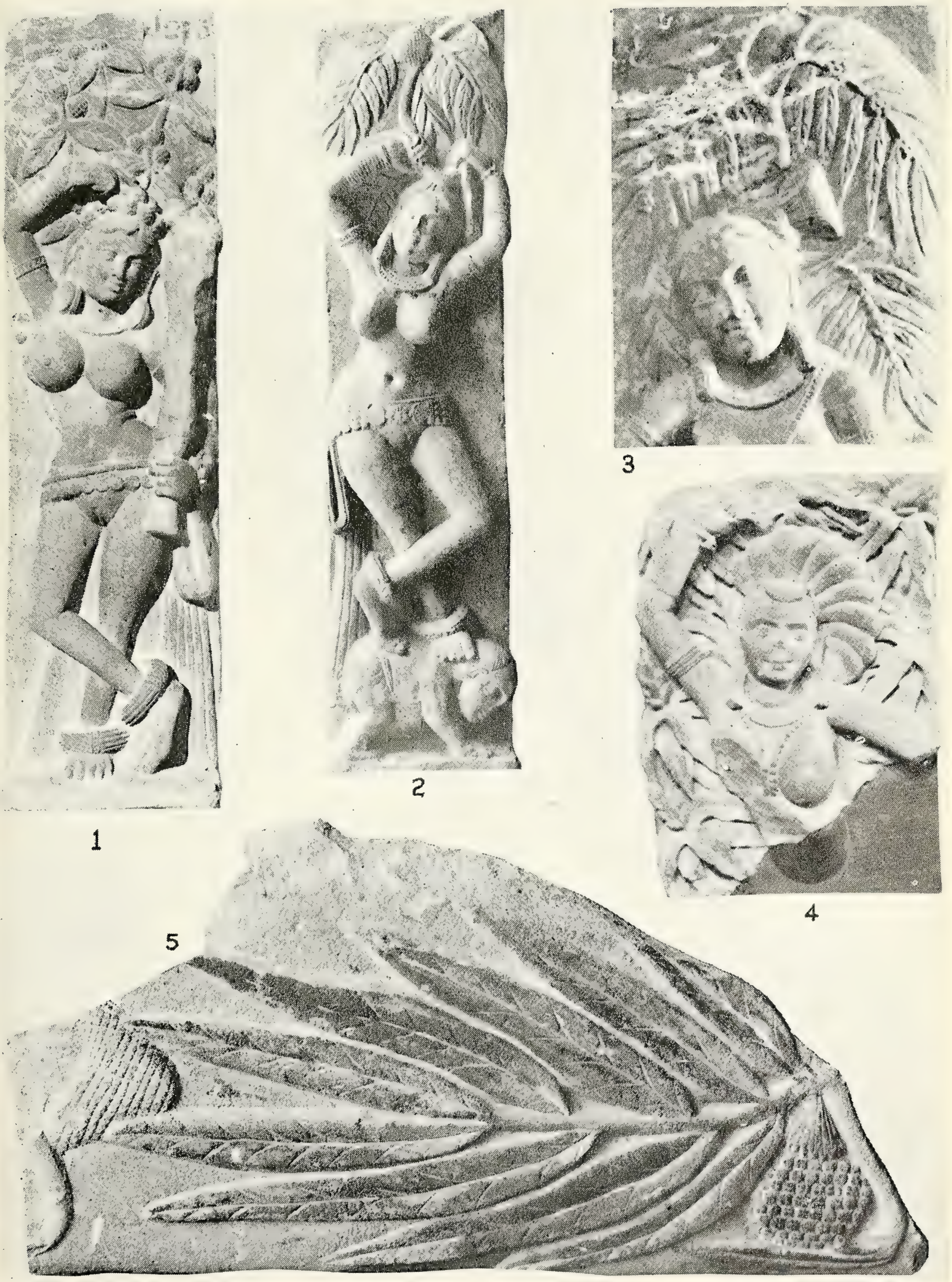


Photo by Randhawa.

Progressive desiccation of Northern India in historical times.

(For explanation of the plate see end of article.)

rainfall of 40 inches *Saraca indica* grows with great difficulty in gardens as it is very susceptible to hot winds. It is commonly confused with another cultivated South Indian tree, *Polyalthia longifolia,* and even Sanskrit scholars, who ought to know better, call this much less attractive tree Asoka. This shows how completely the people of these parts have forgotten the real Asoka tree due to its extinction in these parts centuries ago.

From the present natural distribution of these four trees and particularly that of *Saraca indica* Linn. one can safely infer that about 2,000 years ago, Mathura district which has almost become a desert with an average rainfall of about 24 inches had a much higher rainfall. It is probable that Mathura and North India enjoyed a comparatively wet and mild tropical climate. This is inferred not only from the presence of tropical trees like *Saraca indica, Michelia champaca* and *Mesua ferrea,* but also from the frequent use of lotuses in architecture. In Mathura sculptures we find lintels carved with lotus buds and flowers, and women wearing lotus garlands. The resemblance of the dress of Mathura women with the women of present-day tropical island of Bali who are also undraped from waist upwards is apparent. So the comparative nakedness of the women of Mathura in the Kushan period is not due to sensuousness of the inhabitants, but an adaptation to a mild tropical climate. The wet nature of the country is also proved from the figures of women shown bathing under waterfalls. Waterfalls are found only in rocky places with heavy rainfall.

Use of aquatic or semi-aquatic animals in sculpture.—The frequent use of aquatic animals like fish and alligator in decoration of pillars and gate-ways, and of domestic animals like elephants which flourish in heavy forest also point in the same direction.

Past distribution of Saraca indica Linn.—The past distribution of *Saraca indica* Linn. in Northern India, the region from which it is absent now is established from archaeological evidence and literary evidence from ancient Sanskrit literature (Map I).

1. *Archaeological Evidence.*—*Saraca indica* Linn. was the most popular tree with the Mathura sculptors of Kushan period, and the presence of this tree in Mathura from *Circa* 1 A.D. to *C.* 176 A.D. is well-established from the railing pillar 'Woman and Tree' figures of Mathura. In the sculptures of Sanchi in Central India which date from first century B.C., we also find this tree. In Sanchi sculptures we find a bracket which has been wrongly described by Sir John Marshall as a Bignonia tree bracket. The shape and arrangement of its leaves and structure of its flowers show that it is an Asoka tree. We also find a beautiful figure of a woman under an exquisitely carved Asoka tree in sculptures from Barhut in Nagod State, Central India. The Barhut sculptures date from the period of Sungas from 112 B.C. to 72 B.C. In a Ramayana panel of a Gupta temple at Deogarh, near Lalitpore in the Jhansi district, we find the branches of an Asoka tree. Guptas ruled from 320 A.D. to 490 A.D. and in those days this tree was probably flourishing in the now arid district of Jhansi. We also find the Asoka tree depicted in Ajanta paintings dating from 500 A.D.

Evidence from Sanskrit Literature.—We find numerous references to the Asoka and the Nipa (*Anthocephalus indicus*) in Sanskrit literature particularly in the Ramayana and Mahabharata, works of Kalidasa, and Harsha's 'Ratnavali'. An author usually incorporates the description of those trees which he observes, and from this point of view the references we find to Asoka and Nipa trees in ancient Sanskrit literature are valuable in ascertaining their distribution.

Macdonnel has concluded that the kernel of the Ramayana was composed between *C.* 200 B.C. and *C.* 500 B.C. In the Ramayana it is mentioned that Sita was kept by Ravana in an Asoka grove in Lanka. Asoka trees are still found in Ceylon and the West Coast of Bombay. When Rama returns to Ayodhya after rescuing Sita from Ravana it is described that he bade farewell to his friends and allies and retired in an Asokavatika.

Though it is difficult to be precise about the date when the epic Mahabharata was written, and the place of origin Vyas historians generally agree that it was composed between *C.* 500 B.C. and *C.* 400 A.D. From the descriptions which the author has given one may safely presume that he lived somewhere in the area between the Srasvati and the Ganges. In 'Van Parab' in which the exile of the Pandava is described we find references to Kadamba trees in Dwait forest. This forest existed in the region, covered by the present districts of Saharanpore and Dehra Dun. Similarly we find a reference to Kadamba trees in Kamyak forests which existed south-west of Delhi, and it is likely that the existing Kadamba forests in Mathura and Bharatpore are remnants of this ancient Kamyak forest.

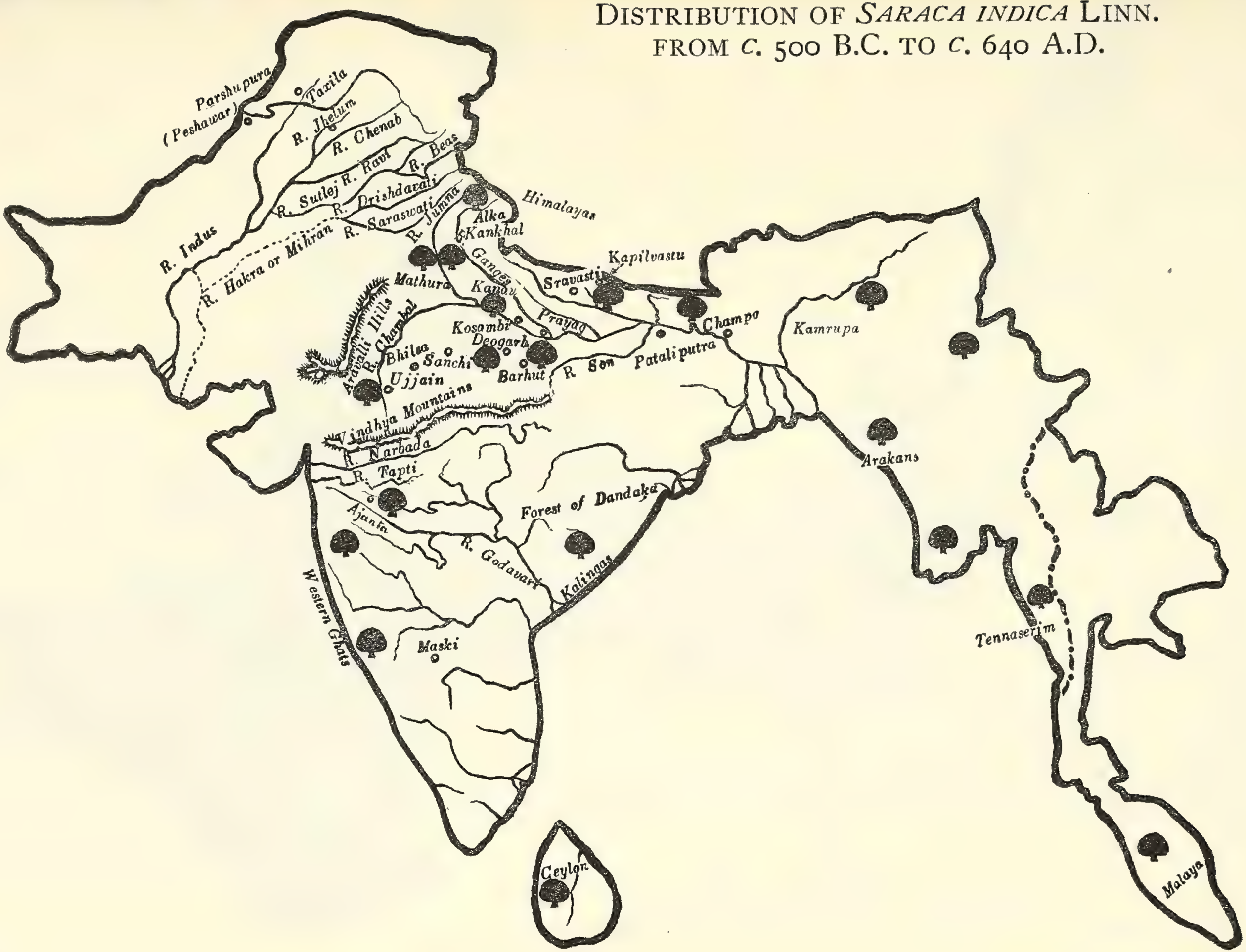
Though it has not been historically established as to when Krishna lived, we at least know that the authors of the epic Mahabharata were familiar with jungles of *Anthocephalus indicus* in the neighbourhood of Mathura, and that is why we find Krishna so intimately associated with this tree. That this is an accurate record is proved from the remains of a Kadamba forest in Mathura.

We find numerous references to the Asoka tree in Buddhist literature. Among the trees associated with the miraculous birth of Buddha which took place in Lumbini garden near Kapilavastu, we find the Asoka tree mentioned along with Mango, Dhak (Plaksa) and Sal trees. In the description of a Buddhist sanctuary, Punnabhadde near Campa we find the Asoka tree conspicuously mentioned. As Ananda Coomaraswamy quotes, 'This sanctuary was encompassed round by a great wood. In the wood was broad mid-space and therein was a fine Asoka tree.'

There is a consensus of opinion among most historians that the famous dramatist Kalidasa was a native of Malwa, and was contemporary of Chandra Gupta, II Vikramadatiya and lived between *C.* 375 to *C.* 455 A.D. Kalidasa has left us accurate descriptions of the ancient city of Ujjain and from his accounts it is evident that the Asoka tree was common in and about Ujjain.

Kalidasa describes Nipa forests (*Anthocephalus indicus*) near Nichai hill near Sanchi, and along the banks of Reva (Narbada river). He also describes 'a red-bloomed Asoka tree with tremb-

DISTRIBUTION OF *SARACA INDICA* LINN.
FROM *C.* 500 B.C. TO *C.* 640 A.D.


Parshupura
(Peshawar)
Taxila
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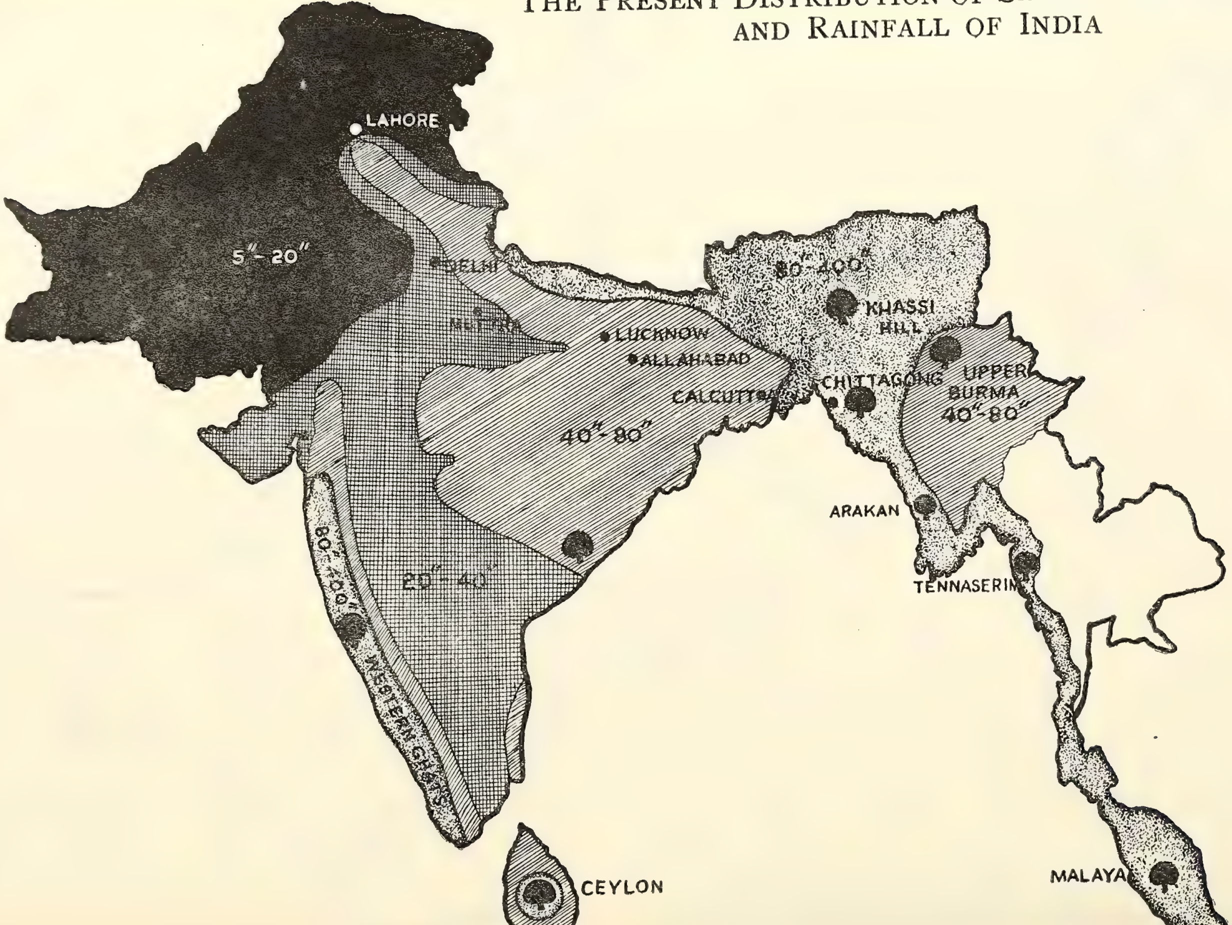
R. Chenab
R. Ravi
R. Beas
R. Sutlej
R. Drishdavati
R. Saraswati
R. Jumna
R. Indus
R. Hakra or Mihran
Himalayas
Alka
Kankhal
Ganges
Mathura
Kanau
Kapilvastu
Sravasti
Prayag
Champa
Kamrupa
Kosambi
Deogarh
Aravalli Hills
R. Chambal
Bhilsa
Sanchi
Ujjain
Barhut
R. Son
Patali putra
Vindhya Mountains
R. Narbada
R. Tapti
Ajanta
Forest of Dandaka
R. Godavari
Kalingas
Western Ghats
Maski
Arakans
Tennaserim
Ceylon
Malaya

THE PRESENT DISTRIBUTION OF *SARACA INDICA* LINN. AND RAINFALL OF INDIA


LAHORE
5"-20"
DELHI
MUTTRA
LUCKNOW
ALLAHABAD
CALCUTTA
40"-80"
20"-40"
80"-400"
WESTERN GHATS
CEYLON
80"-400"
KHASSI HILL
CHITTAGONG
UPPER BURMA
40"-80"
ARAKAN
TENNASERIM
MALAYA

ling leaves' in the town of Alaka in the Himalaya, which was possibly in the outer Himalayas of Garhwal. The Asoka occurs at present in the lower elevations of the Himalayas eastwards of Kumaon. In the age of Kalidasa it was growing further north as far as outer-Garhwal above Hardwar.

In the celebration of seasonal festivals of spring in ancient India we find numerous references to the Asoka. There was a favourite festival celebrated in spring known as 'Asoka-pushpa-prachyika', gathering of Asoka flowers when young women collected them. Vatsayana, the celebrated author of *Kam Sutra,* the Hindu encyclopaedia of sex, probably lived at Ujjain in 4th century A.D. in the reign of the Guptas. In his description of popular festivities (Samasyakrida) he mentions seventeen seasonal festivals including an Asoka festival and a Kadamba festival, when people fought mock battles with ball-like Kadamba flowers. We find a description of worship of the Asoka tree at Kanauj during the celebration of the spring festival, Madan Utsav, in Harsha's Ratnavali which was written about 600-648 A.D. It is also mentioned that the citizens of Kanauj decked themselves with the Asoka flowers. Such activities are possible only if the Asoka trees were growing in abundance in these localities.

REMNANTS OF 'KADAMBA' FORESTS IN MATHURA.

Another reason which supports the presumption of the presence of Asoka forests in Kushana Mathura is that we still find remnants of Kadamba forests in the Mathura district. We find an unmistakable 'Kadamba' tree in one of the railing figures from Kanakali Tila. As compared with the 'Kadamba' tree the 'Asoka' was much more frequently sculptured by Kushan sculptors, and consequently it can be deduced that *Saraca indica* Linn. was a commoner tree than *Anthocephalus indicus* Rich., and very probably there were widespread forests of this tree. While the more moisture-loving *Saraca indica* has disappeared on account of increasing desiccation, the comparatively more drought-resistant *Anthocephalus indicus* has survived in some swampy pockets. Sir Digby Drake-Brockman, who compiled the Gazetteer of Mathura district, describing the vegetation writes: 'Many of the villages stand out devoid of trees; but near others, especially those of old standing, there are fairly large commons known as 'rakhya or kadamb' woods (Kadamb Khandi). The poorer specimens of these are merely uncultivated land covered with 'karil, 'pilu', 'hins' and other jungle shrubs; but in the better ones there are large 'kadambas' (*Anthocephalus cadamba*) and other fine jungle-trees which make these 'rakhyas' look like pieces of real forest. Many of these are of considerable size.'

These so-called 'kadamba rakhyas' or 'kadamba khandis' are barren waste-lands supporting only xerophytic shrubs and herbs used as pasture land by villagers. While the 'kadamba' trees have vanished, the name has lingered as a vestigial feature reminding one of the wet days of Mathura, when it was surrounded by luxuriant tropical evergreen forests. Mr. Babu Lal Gupta who has made a detailed study of the vegetation of the 'Brij' the Bharatpore-Agra-

Mathura area reports that Kadamba trees are still planted near some temples and along roadsides in Mathura. He also found a remnant of Kadamba forest in Keola Deo Jungle near Bharatpore. Some of these trees are as much as one hundred years old, and Mr. Gupta is of opinion that these are possibly the remnants of Kadamba forests on the verge of extinction.

The forest at Chhata, which is described in the Gazetteer as the largest Kadamba forest, contains very few Kadamba trees now and is mostly filled with Neem and Babul. In 'Kokila Ban' at Bathan almost all the Kadamba trees have disappeared in the last 30 years, and old inhabitants of Bathan say that about 30 years ago it was all a Kadamba forest. Large empty spaces have appeared in the Kadamba forest at Nandgaon as several Kadamba trees have died off. These observations of Mr. Gupta show that Kadamba trees in 'Brij' area are on the verge of extinction due to lack of sufficient moisture and this may mean the end of the ancient 'Kamyak Ban' of Mahabharata in the near future.

FROM EVER-GREEN TROPICAL FOREST TO DESERT.

The present vegetation of the 'Brij' country is xerophytic, and is not very different from that of the Rajputana desert. The average annual rainfall of Mathura is 23.61″, which is the lowest in the United Provinces, and that of Agra is 25.1″. After the close of the cold months, the temperature rises rapidly in the month of March, and humidity goes down. Night temperatures shooting upto 114° F. in the shade, and desiccating hot west winds from the rocky Aravalli hills and sandy deserts of Rajputana, often accompanied by dust-storms in May and June have produced a typical desert vegetation of xerophytes, with adaptations against dry conditions and with devices for conserving moisture. The commonest trees are the leafless Karils (*Capparis aphylla* Roth.), the ungraceful pilu (*Salvadora oleoides* Dcne.), with tough leathery leaves, the ubiquitous Babul (*Acacia arabica* Wild.), the feathery-leaved Chonkar (*Prosopis spicigera* Linn.), the Hingot (*Balanites aegyptiaca* Delile), Pasendu (*Diospyros cordifolia*), Pilkhan (*Ficus cordifolia*) and several species of *Tamarix* with reduced scaly leaves. The waste spaces between the villages are more or less bare with occasional patches of Jharber (*Zizyphus rotundifolia* Lamk.), *Salvadora persica* Linn., and Dhak (*Butea frondosa*). The rocky areas are covered with hardy shrubs like Dho (*Anogeissus parviflora*). Among the herbaceous vegetation we find such interesting xerophytes such as Kheep (*Leptadenia spartium* Wight) with erect cylindrical almost leafless branches, the spiny Jawasa (*Alhagi camelorum* Fisch.), and the deep-rooted Ratanjot (*Arnebia hispidissima* DC). In the shade of the prickly bushes of *Capparis sepiaria* Linn. grows the inconspicuous drought-resistant Gillirgitta (*Ceropegia bulbosa* Roxb.)

The 'Brij' country which was covered with luxuriant evergreen tropical forests of *Saraca indica, Mesua ferrea* and *Anthocephalus indicus* about 2,000 years ago has completely changed now. The jungles which were the abode of the rhinoceros and the wild elephant, have disappeared, and in their place we find sandy wastes haunted by flocks of black back and chinkara deluded by mirages of rivers and lakes which exist no more. The ponds and lakes which were filled with pink and white lotuses and visited by ducks and wild geese providing inspiration to the Kushana sculpture, have completely disappeared, and in their place we see ravines, sand dunes and parched plains which have become the rendezvous of the Grey Partridge (*Francolinus pondicerianus* Gmelin.), quail (*Coturnix coturnix* Linn.) and the sand-grouse (*Pterocles exustus* Temm. and Lang.) the typical birds of the Rajputana desert.

I acknowledge with thanks the help I have received frim Dr. V. S. Agarvala, Curator Provincial Museum, Lucknow, in various ways. I am also grateful to Mr. Babu Lal Gupta of Agra College, Agra, for making use of his valuable observations on the vegetation of 'Brijj' area, to Dr. A. C. Joshi of Hindu University, Benares, for the benefit of his views, and to Dr. K. Biswas, Superintendent, Royal Botanic Garden, Calcutta, for so kindly sending information about the distribution of trees discussed in this paper and supplying preserved specimens for comparison.

EXPLANATION OF PLATE.

Mathura Sculptures of Kushan Period.

Fig. 1—A woman under a Kadamba tree (*Anthocephalus indicus* Rich.)
Fig. 2.—A woman under an Asoka tree (*Saraca indica* Linn.)
Fig. 3.—A woman under a Nag-kesar tree (*Mesua ferrea* Linn.)
Fig. 4.—A woman under a Champak tree (*Michelia champaca* Linn.).
Fig. 5.—A sculptured fragment showing leaves and flowers of *Saraca indica* Linn.

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LIFE-HISTORY AND BIONOMICS OF TWO PREDACEOUS AND ONE MYCOPHAGOUS SPECIES OF *COCCINELLIDAE.*

BY

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(*With a plate*)

INTRODUCTORY.

Ladybird beetles may be harmful or beneficial, the former being the reputed pests of certain crops and vegetables, while the latter include predaceous as well as mycophagous species. With the recent development of biological control of insect pests the study of predaceous species has achieved considerable importance. The first successful experiment of this nature, was carried out in California in 1889 to control cottony cushion scale, *Icerya purchasi* through the agency of a ladybird beetle, *Rodolia cardinalis* Muls. from Australia. This enterprise served as a stimulus to applied entomology in the field of biological control. Since the application of predators under field conditions, needs a thorough knowledge of their bionomics and seasonal activities, the present investigations were taken up with a view to studying in detail some of the important species of this province, namely (1) *Chilomenes sexmaculata* Fabr. (2) *Coccinella septempunctata* L. and (3) *Thea cincta* Fabr. Their life-history, morphological characters and habits etc., are described below:—

HISTORICAL.

Mulsant (1866), Crotch (1873), and Gorham (1894), contributed valuable information on the systematics and distribution of various species of coccinellids. Stebbing (1903) published an account of 16 predaceous species from India and included them in 11 genera. His descriptions include generic characters, life histories of some of the species, feeding habits, distribution as well as description of the adults of *Coccinella septempunctata* and *Chilomenes sexmaculata*. Lefroy (1906) gave the broad characters of the family *Coccinellidae* and briefly described some of the species, with short notes on the colouration of the larvae and adults of *Coccinella septempunctata*, and *Thea cincta* and the life-history of *Chilomenes sexmaculata*. Clausen (1915) added notes on the life-histories, and other biological features of about ten different species except the ones selected for this study. Tullgren (1916) recorded for the first time *Perilitus terminatus,* a parasite of the larva of *Coccinella septempunctata*. Subramanyam (1923) published a list of 38 species and briefly described the adults, feeding habits, distribution and life-histories of a few species, and colour variation in *Chilomenes sexmaculata*. He also described briefly the immature stages of *Thea cincta* and three distinct types of adults in *Chilomenes sexmaculata*. Dobrzhansky (1926) added valuable notes on the systematic position of some genera of *Coccinellidae* on the basis of their genitalia and also studied *Coccinella septempunctata* in this respect, whereas Strouhal (1927) has brought out some structural variations in the mandibles of *Epilachninae, Coccinellinae,* and *Psylloborini* as diagnostic characters. Pradhan (1935) contributed on the study of genitalia in *Epilachna indica* and referred to the male genital tube of *Chilomenes sexmaculata* while Volkov (1937) added information on the food of *Coccinella septempunctata* feeding on two species of moths recorded on cotton.

TECHNIQUE.

The material was collected from various crops at the Agricultural College Farm, Poona. For laboratory observations however, rearing was managed in glass jars or tubes of 3″ × 1″ with muslin tied at the open end. The mycophagous larvae could be reared successfully upto the third instar in similar jars simply by providing small pieces of leaves infested with fungus.

Feeding habits were studied under controlled experiments. The beetles, however, were given more aphids than was actually needed. The first and second stage larvae were fed on young nymphs.

For the study of the mouth parts, specimens were treated in 10 per cent. KOH solution and boiled for about ten minutes. The mouth parts were dissected out, washed in fresh water and preserved in 70% alcohol. The larvae of the first two instars were treated in the same way, but the grown up larvae and the pupae were punctured before treating them with KOH and were kept over night for penetration. The copulating adults were killed instantaneously with chloroform, and treated similarly for further studies. For the study of digestive system, the material was fixed in Carnoy's fluid, white for other systems Allan's modification of Bouin's fluid and corrosive sublimate were used. Acid fuschsin proved a useful stain for general purposes, but double staining with Delafield's haematoxylin and eosin was rather more effective. Sketches were made with a Camera Lucida.

DESCRIPTION OF STAGES.

Chilomenes sexmaculata—Egg.—Smooth, cigar-shaped, standing erect deep yellow when fresh, light yellow when about to hatch. Average measurements 1.0 mm. x 0.45 mm. micropyles 26 to 30 arranged in a circle at the free end.

1st Instar Larva.—Yellowish-white when newly hatched, turns to grey subsequently, average measurements 1.65 mm. x 0.46 mm. faint coloured patches on the body; compound spines distinct, bristles variable; head broader posteriorly, bristles 15 pairs, ocelli three, antennae two joined. Prothorax transversely oval, margins rimmed, beset with 8-10 bristles on each side, a compound, well developed spine laterally and a smaller one on each side near the mid-dorsal line and near the posterior edge. The meso- and -metathorax have two dorso-lateral compound spines and two smaller ones in the middle of each segment. Each abdominal segment except the last, provided with six compound spines—two median, two dorso-lateral and two lateral, these constitute six longitudinal rows of compound spines; bristles variable in different regions, terminal portion tubular, anal-foot fleshy, broader at the free end and provided with a sucker.

2nd Instar Larva.—Average measusements 2.62 x 0.62 mm.; head 0.34 x 0.48 mm. shining black, compound spines and bristles as in the previous instar, dorsal spines on the fourth and the dorso-lateral spines on the first abdominal segments, white.

3rd Instar Larva.—Average measurements 4.24 x 0.97 mm.; head 0.45 x 0.61 mm. colour deep black, spines as in previous instar.

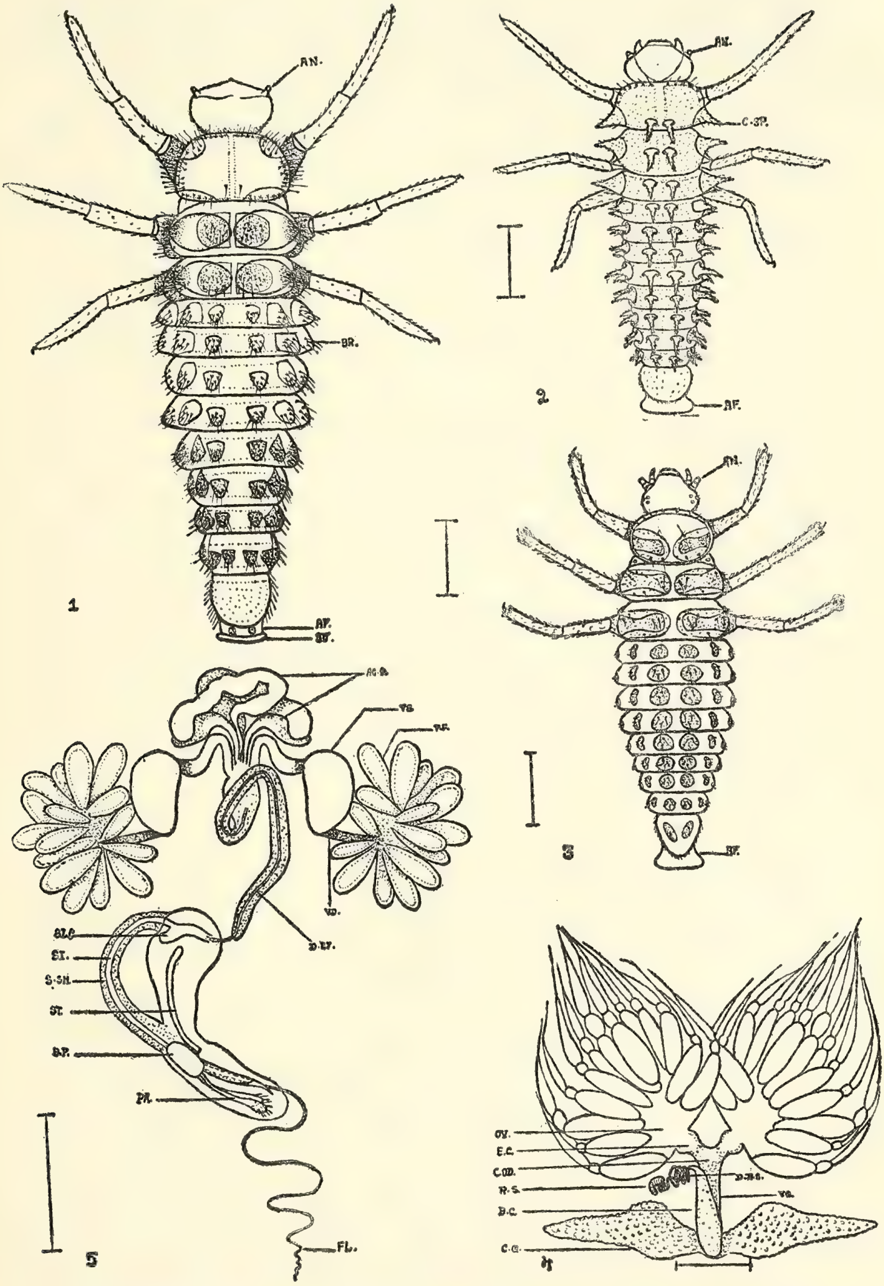
4th Instar Larva.—(Pl. 1. Fig. 2). Average measurements 7.10 x 0.97 mm.; thin white band at the anterior margin of prothorax, white patches between the median pairs of spines and especially between those on the thoracic segments, head brown anteriorly, black posteriorly, legs longish in appearance.

Pupa.—Average measurements 3.65 x 2.65 mm.; oval from above, irregular posteriorly, whitish-yellow with black markings; prothorax deflexed, anterior portion rimmed ventrally, spotted with black posteriorly; elytra visible within sacs; mesothorax with two semicircular black marks, one on each side, posterior edge with a thick oblique black band; metathorax with similar black markings; second to sixth abdominal segments with a pair of pyramidal black marks, one on each side of the mid-dorsal line.

Adult.—Three types—only colour variations, oval, convex above, measurements vary from 3.99 mm. to 5.5 mm.; males smaller than the females, head yellowish-white anteriorly, black posteriorly, 0.88-1.05 mm. in length and 1,00-1.36 mm. in breadth; eyes black, bean-shaped, relatively larger in males; antennae clavate, eleven segmented, 0.44-0.58 mm. long, club three or four jointed; mouth parts modified into chewing and biting type, prostheca present, mandibles bifid at the apex, with a basal tooth; prothorax yellow, orange or orange-red with a black spot in the middle, 0.85 to 1.16 mm. long, 2.00-2.55 mm. broad, concave anteriorly, lateral margins deflected. Elytra yellow, orange or orange-red each with two transverse zigzag dark bands, 0.1 mm. broad, and a black oval spot near the apical angle, on an average 3.12 mm. in male, 3.81 mm. in female. Legs retractile, tibia with two spurs at the distal end, the tarsus four jointed, first two segments pubescent, the third minute and the fourth long and thin ending in two claws, the last sternum flat in male with hinder margin notched, triangular in female, a portion of the pygidium visible in male.

Coccinella septempunctata—Egg.—Smooth, cigar-shaped, standing erect, deep yellow, measures on an average, 1.29 mm. x 0.53 mm. micropyles 30, arranged in a circle at the free end.

1st Instar larva.—Black with darker patches—dorsally two on each thoracic segment and laterally two on 2nd and 3rd thoracic segments; six patches on each abdominal segment—two medium, two dorso-lateral and two lateral, ave-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Life-history and Bionomics of predaceous and mycophagous *Coccinellidae.*

For explanation see end of article.

rage measurements 1.88 mm. x 0.50 mm., head with 18 pairs of bristles, antenna two jointed, prothorax 15-18 pairs, distributed around rim, meso- and metathorax with nine pairs, 2-5 bristles laterally, three prominent bristles on each abdominal segment at the region of the patches. Ventrally the larva possesses protuberances distributed in the thoracic and abdominal region.

2nd Instar larva.—Black, average measurements 3.43 mm. x 0.81 mm. patches as in the previous instar, dorso-lateral and laterals on the first abdominal segment transformed into orange, and dorso-lateral sides of the prothorax develop warts; number of bristles on each segment increased by 3-5 smaller ones, ventral protuberances developed into bristles and distributed as in previous instar.

3rd Instar larva.—Average measurements 5.02 mm. x 1.28 mm. dorso-lateral and lateral patches on the first abdominal segment deep orange and similar ones on the fourth abdominal segment, bristles on prothorax and warts on all the abdominal segments prominent, ventral groups of bristles as in the previous instars.

4th Instar larva.—(Pl. 1, Fig. 1). Average measurements 11.95 mm. x 2.52 mm. when full grown; head yellow; four orange patches on prothorax, orange coloured dorso-lateral and lateral patches on the first and fourth abdominal segments, warts well developed, ventral bristles conspicuous, rest as in other instars.

Pupa.—Shape similar to the previous example, average measurements 5.67 mm. x 3.83 mm., deep yellow when fresh, subsequently develops black markings, a pair of orange spots on the first abdominal segment and two pairs on the fourth. Eyes prominent; prothorax yellow with two pairs of black dots; mesothorax and metathorax with one pair each; elytra extending to the first two abdominal segments, decorated with three black dots; second to the sixth abdominal segments each with a pair of median and dorso-lateral patches, spiracles distinct.

Adult.—Measurements vary from 5.55-7.27 mm., males relatively smaller in size, oval, convex above; head black, broader posteriorly, mouth parts as in the previous species, white spots near the eyes, each measures 1.27 mm., x 1.62 mm., antennae eleven segmented, 0.88 mm. long. scape the longest, terminal segment the broadest; prothorax deep black with two quadrangular white patches on the anterior angles, more than twice as broad as long, measures 1.34 mm. x 3.14 mm. Proximal tarsal joints pubescent, tibia with two spurs at the distal end; elytra yellow, orange or orange-red, each with three black circular spots longer than broad, average measurements 5.32 mm. x 5.03 mm. The last sternum triangular in female, the anal margin notched in the male.

Thea cincta —*Egg.*—Cigar-shaped, creamy white, chorion sculptured, average measurements 1.04 mm. x 0.4 mm., micropyles 30 in a circle at the free end.

1st Instar larva.—Yellow dorsally, ventral surface white, average measurements 1.61 mm. x 0.38 mm., head with black spots and 18 pairs of bristles, oceli three, antenna three jointed, prothorax rimmed, bloched, bristles 10-12 pairs, abdominal blotches each beset with three bristles.

2nd Instar larva.—Same as in the previous instar, average measurements 2.85 mm. x 0.59 mm.

3rd Instar larva.—Practically similar to that of the previous instar, average measurements 3.68 mm. x 0.91 mm., prothoracic bloches not complete.

4th Instar larva.—(Pl. 1. Fig. 3). Thorax deep yellow, bloches divided, abdomen banded. Measurements 4.95-6.6.3 mm. long and 1.44-1.88 mm. broad.

Pupa.—Deep yellow, average measurements 4.08 mm. x 2.75 mm., prothorax rimmed, white, mesothorax slightly depressed in the middle, two black spots; faint black patches on 1-4th abdominal segments, elytra do not meet in the middle.

Adult.—Measurements 4.0 to 4.8 mm. long. males relatively smaller than the females, head yellow, broader than long, measures 0.45 mm. x 1.14 mm.; eyes bean-shaped, relatively bigger in male; mandibles bifid apically,[1] tips dentate antennae eleven segmented, 1.22 mm. long., scape the longest, terminal segment the broadest, last but two segments serrate, prothoax concave anteriorly, curved laterally, broader than twice its length, measurements 0.86 mm. x 2.18 mm., yellowish with two black spots; elytra yellow, rimmed, average measurements 3.52 mm. x 3.42 mm., legs long, yellow, claws each with a basal tooth; last sternum as in the previous example.

FOOD

The predaceous species feed on aphids which have been recorded from the following plants :—

Serial No.	Common English name	Botanical Name.	Family
1.	Safflower	*Carthamus tinctorius*, L.	*Compositae.*
2.	Cabbage	*Brassica oleracea*	*Cruciferae.*
3.	Knolkhol	,, sp.	,,
4.	Turnip	,, *campestris*, L.	,,
5.	Radish	*Raphanus sativas*, L.	,,
6.	*Tondli*	*Coccinia indica*, W. & A.	*Cucurbitaceae*
7.*	*Jowar*	*Andropogon sorgham*, Brot.	*Gramineae.*
8.	Cluster bean	*Cyamopsis psoralioides*, Dc.	*Leguminosae.*
9.	Lentil	*Lens esculentas*, Moench	...
10.*	Lucerne	*Medicago sativa*, Linn.	...
11.	Pea	*Pisum sativum*, L.	...
12.	Linseed	*Linum usitatissimum*, L.	*Linaceae.*
13.*	Cotton	*Gossypium* spp.	*Malvaceae.*
14,	Lady's finger	*Hibiscus esculentus*, L.	...
15.*	Mosambi	*Citrus* spp.	*Rutaceae*
16.*	Brinjal	*Solanum melongena*, L.	*Solanaceae.*
17.	Chilly	*Capsicum annum*, L.	...
18.	Potato	*Solanum tuberosum*, L.	...
19*	Tobacco	*Nicotiana tabacum*, L.	...

N.B.—1. * The plants recorded by the previous workers, others are recorded by us which may probably be new ones.

2. The predaceous species have also been recorded on the following plants : (1) Mountain spinach, (2) A spider wort, (3) Bur weed. (4) Chrysanthemum, (5) Coreopsis aristosa, (6) a knot grass, (7) Petunia and (8) Dill.

LIFE HISTORY.

Oviposition.—Copulation may take place throughout the day. This, however, is not in conformity with Pradhan (1934-35). First copulation after emergence usually takes longer and may last upto two hours. Eggs are generally laid in batches on the under surface of leaves. Copulation as well as oviposition are continued during the life of the adults and sometimes parthenogenetic eggs may also be laid which are usually scattered and do not hatch. In *Chilomenes sexmaculata* Fabr. eggs in each batch are laid in 2-3 rows and their numbers varied from 9 to 22 with a maximum of 2,384 eggs per female in 2 months and 9 days. Pre-oviposition period ranges from 2-4 days. *Coccinella septempunctata* L. lays in irregular batches with a maximum of 82 eggs recorded so far in a batch. Pre-oviposition period varies from 4-5 days during monsoon and 7-10 days during winter. The maximum number of eggs laid by a female was 3,765 in 2 months and 21 days. Eggs of *Thea cincta* Fabr. are also laid in rows and the maximum number recorded in a batch was 28.

Incubation period.—The incubation period is about three days during monsoon when the temperature ranges from 68.0 to 90° F. During winter, however, with the fall in temperature this period extends to four days. Normally hatching is cent per cent but the newly hatched grubs may devour the unhatched eggs. The egg hatches by a vertical slit at its free end. The larva rests over the egg shell and commences free movements after about 3-6 hours.

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[1] In *Epilachna 28-punctata*—a purely phytophagous—form the mandibles, are broad at the base, concave laterally, serrate, basal tooth wanting.

Eggs hatch even when immersed in water but not at a low temperature of 10° F.

Larval stage.—There are 4 instars and the total duration varied from 4.6 days to 14.7 days in all the three species. In *Chilomenes sexmaculata* Fabr. it was 4.6 days during July and August and 14.7 days during November and December. In *Coccinella septempunctata* L. the duration was 9.16 days during October and 11.15 days during January and February, and that of *Thea cincta* Fabr. 11.29 days and 12.56 days during July and November-December respectively.

Pupal stage.—Fullgrown larva attaches itself by the hinder end and transforms into a pupa. The pupal stage on an average, extended from 3 to 5.7 days.

Life-cycle—(Table I).—The duration of life-cycle varies from 11-23 days according to the season. The shortest duration was noticed during April and May when the temperature varied from 78° F. to 98° F. During December and January, however, with the fall in the temperature, the duration of life-cycle extended to 23 days. During August 1938 to June 1939 fifteen generations of the predaceous species were reared under laboratory conditions but it has been estimated that about twenty generations may pass during one year.

The average life-cycle of *Chilomenes sexmaculata* Fabr. during monsoon when the maximum and minimum temperatures ranged between 75 to 90° F. and 68-78° F. respectively, was 10.6 days, but it extended to about 22.9 days during winter when the temperatures were comparatively lower. The life-cycle of *Coccinella septempunctata* L. was on an average 16.2 days during the month of October and 18.8 days during January and February while that of *Thea cincta* Fabr. was 17.3 days in July and 20.4 days during November and December. The duration during the month of July however, was very much prolonged as compared with other species.

Longevity of adults.—The beetles are long lived and under laboratory conditions the adults of *Chilomenes sexmaculata, Coccinella septempunctata* and *Thea cincta* could survive for about four months, five months and three months respectively. The females when kept alone lived for a relatively longer period.

Habits.—The adults are usually found on the under-surface of leaves. They feign death when disturbed and exude a viscid liquid. This liquid is yellow or amber in colour in the predaceous species and whitish with a tinge of yellow in the mycophagous species.

SEASONAL HISTORY.

In nature *Chilomenes sexmaculata* Fabr. always outnumbers *Coccinella septempunctata* L. in spite of its relatively lower fecundity. From June to February both the species are found on various crops infested by aphids but during summer they are mostly found on lucerne. *Thea cinta* Fabr. on the other hand, found in plentiful on cluster beans and lady's finger during monsoon and on *Coccinia indica* during winter. During hot weather however, adults of *Chilomenes sexmaculata* Fabr., and *Coccinella septempunctata* L. were also found feeding on young nymphs of *Pundaluoya simplica,* on jowar shoots. It has been observed that *Coccinella septempunctata,* L. and *Chilomenes sexmaculata* Fabr. are found almost in association with each other, and the females generally predominate in numbers (Table II). The two predaceous species are active throughout the year whereas *Thea cincta* Fabr. is not met with during summer. Of all these beetles *Coccinella septempunctata* L. may live upto 41 days without food, but *Thea cincta* Fabr. could not survive for more than four days under such conditions. Under low temperatures however, the adults of *Chilomenes sexmaculata* died after 7 days at 20° F while those at 42° F lost their activity and entered hibernation much earlier. At 50° F the insects showed some activity even after a week.

ECONOMIC IMPORTANCE.

The adults of the predaeceous species are more important than their larvae. Lefroy (1906) remarks that a single larva of *Chilomenes sexmaculata* Fabr. consumes about 2,400 aphids during its life-time. This is contrary to our observations because the maximum number of aphids that a single larva could consume during its larval period was 303 in *Chilomenes sexmaculata* and 420 in *Coccinella septempunctata.* The feeding capacity increases with the age.

The adults, however, are great feeders. The maximum number of aphids consumed by a pair of *Chilomenes sexmaculata*, was 16,321 and of *Coccinella septempunctata*, 22,574, during their life, with an average of 60.84 and 106.29 per adult per day respectively.

According to Fernald (1936) about 30,000 adults of *Hippodamia convergens* proved effective over an area of 10 acres, while Dutt (1927) concluded that 3,000 ladybird beetles were enough to control the aphids within fifteen days, in an area of 1,200 sq. feet.

Our observations under controlled conditions yielded that 75 adults of *Chilomenes sexmaculata* could destroy practically all aphids from five cabbage plants which were severely infested with them. With these encouraging results it may be presumed that satisfactory biological control may be achieved through the application of these beetles.

INTERNAL ANATOMY.

Alimentary system.—*Chilomenes sexmaculata* Fabr. Paired pouches anterior to proventriculus and gastric coeca as observed by Landis (1936) in *Ceratomegilla fuscilabris* Muls. are not present, enteric coeca prominent, salivary glands wanting; malpighian tubes six in number.

REPRODUCTIVE SYSTEM[1].

Female.—

Chilomenes sexmaculata Fabr. (Pl. 1, Fig. 4).—Two ovaries, each consisting of 20 ovarian tubules, oviducts, vagina, bursa copulatrix and the receptaculum seminis. Each oviduct measures 0.55 mm., bursa copulatrix stands dorsally on the vagina having its anterior end tapering and somewhat tilted towards the left side on the 4th sternite; receptaculum seminis small, curved, chitinous sac. There is a small accessory gland for the receptaculum seminis. A pair of collecterial glands open laterally in the vagina.

Coccinella septempunctata L.—Each ovary consists of fifty ovarioles. The receptaculum seminis is attached to the bursa copulatrix by a small, slender duct known as the ductus receptaculi that passes through a funnel-shaped dilatation of the infundibulum. The major part of the infundibulum remains within the bursa copulatrix, and its free pointed end is called the cornu. The distal end of the bursa copulatrix does not taper.

Thea cincta Fabr. Each ovary consists of twenty ovarioles; receptaculum seminis relatively small and ringed, attachment to the bursa copulatrix by a small narrow duct.

Male.—

Chilomenes sexmaculata Fabr. (Pl. I, Fig. 5).—A pair of testes, vasa deferentia, vesiculae seminales, ductus ejaculatorius, two pairs of accessory glands and the copulatory organs. Each testis looks like a bunch of grapes of twenty testicular follicles.

The external genitalia consists of a sipho, the penis, basal plates, a trabes and two paramera. The intramitant organ is the sipho and the covering tube is the penis (Siphonal sheath of Pradhan). Siphonal capsule is strongly chitinized, boot-shaped, the distal part of the penis is fused with the basal plates, strongly pointed and slightly curved. Paramera hairy at distal ends, 0.55 mm. long; trabes (strut) rod-like, broader distally.

Coccinella septampunctata L.—Almost similar to that in the previous species but each testis has fifty testicular follicles; accessory glands very long and coiled.

Thea cincta Fabr.—Testicular follicles twenty, ejaculatory duct long; accessory glands very long and coiled. The paramera longer than those in other two species. The distal end of the sipho is spoon-shaped and bears tender hair-like structures.

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[1] 1. Nomenclature after T. H. Dobrzhansky.
2. Not described in detail in all the species—only differences are given.

SUMMARY.

The life-history of the two predaceous and one mycophagus species namely *Chilamenes sexmaculata* Fabr., *Coccinella septempunctata* L. and *Thea cincta,* Fabr. respectively is described. Eggs are generally laid in batches on the underside of leaves and hatch within 3-4 days. The maximum number of eggs laid by a female of the first two species, was 2384 and 3765 respectively. The larval stage on an average, varied from 4.6 days to 14.7 days and the pupal stage from 3 to 5.7 days. The duration of life-cycle varied from 11 to 23 days, according to the season. About twenty generations have been estimated during the course of a year. The various stages of the insects, their habits and seasonal activities are described. Of the predaceous species the adults have been found more important from the economic point of view than their larvae. The alimentary system of *Chilomnes sexmaculata* Fabr. and the differences in reproductive systems of all the three species are also discussed.

TABLE I

Life-history of all the three species during 1937–39

Species	Months	Average duration of egg stage	Average duration of larval stage (days) Instars I	II	III	IV	Total larval stage (day's average).	Average pupal stage (Days).	Total duration of life-cycle.
Chilomenes sexmncu-lata Fabr. ...	*1937* July-Aug. ...	3·0	1·1	1·0	1·1	1·4	4·6	3·0	10·6
,, ,,	Nov.-Dec. ...	3·0	3·8	2·0	2·0	4·2	12·0	5 8	20·7
,, ,,	December ...	4·0	4·7	2·6	3·5	3·9	14·7	4·2	22·9
,, ,,	July ...	2·5	1·6	1 0	1·2	2 2	6·0	2·8	10·8
,, ,,	Oct.-Nov. ...	3·0	2·8	2·6	2·0	4·4	11·8	5·0	19·8
,, ,,	*1939* Jan.-Feb. ...	3·0	2·3	2·3	2·5	4·8	12·6	3·0	18·0
Coccinella septem-punctata L. ...	*1938* Jan-Feb. ...	3·0	3·0	1·8	1·9	4·0	10·8	5·0	18 8
,, ,,	October ...	3·0	2·0	1·0	2·7	3·5	9·2	4 0	16·2
,, ,,	*1939* Jan.-Feb. ...	3·0	2·8	1·2	2·7	4·8	11·[illegible]	4·0	18·5
Thea eincta Fabr. ...	*1938* Nov.-Dec. ...	3·0	2·6	2·0	2·4	5·6	12·6	4·9	20·4
,, ,,	*1939* uly ...	3·0	2·6	2·4	2 5	4·0	11·3	3·5	17·3

TABLE II

Sex proportion in all the three species during 1938–39

Species	1938														1939									
	June		July		August		September		October		November		December		January		February		March		April			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Chilomenes sexmaculata Fabr.	50·0	50·0	27·3	72·7	41·2	58·8	60·0	40·0	46·5	53·5	41·7	58·3	31·0	69·0	42·9	57·1	35·9	64.1	37·5	62·5	44·5	55·5	36·6	63·4
Coccinella septempunctata L.	...	...	40·0	60·0	...	...	50·0	50·0	37·5	62·5	33·3	66·7	47·1	52·9	58·6	41·4	53·6	46·4	...	...	58·3	41·7	44.5	55·5
Thea cincta Fabr. ...	37·2	62·9	44·1	55·9	51·0	49·0	46·7	53·3	33·4	66·6	26·1	73·9	48·4	51·6	60·0	40·0	46·3	53·7	30·0	70·0	66·7	33·3	...	...

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Abbreviations Used.

AC.G.	Accessory glands.
A.F.	Anal foot.
AN.	Antenna.
B.C.	Bursa copulatrix.
B.P.	Basal plate.
BR.	Bristle.
C.G.	Colleterial glands.
C.OD.	Common oviduct.
C.SP.	Compound spine.
D.EJ.	Ductus ejaculatorius.
D.R.S.	Duct of the receptaculum seminis.
E.C.	Egg calyx.
FL.	Flagellum.
OV.	Ovary.
PA.	Perameron.
R.S.	Receptaculum seminis.
SI.	Sipho.
SI.C.	Siphonal capsule.
S.SH.	Siphonal sheath.
ST.	Strut.
SU.	Sucker.
T.F.	Testicular follicle.
VG.	Vagina.
VS.	Vesicula seminalis.

Explanation of the Plate.

Fig. 1.—Fourth instar larva of *Coccinella septempunctata.* L.
Fig. 2.—Fourth instar larva of *Chilomenes sexmaculata.* F.
Fig. 3.—Fourth instar larva of *Thea cincta.* F.
Fig. 4.—Female reproductive system of *Chilomenes sexmaculata.* F.
Fig. 5.—Male reproductive system of *Chilomenes sexmaculata.* F.

THE MEDICINAL AND POISONOUS STERCULIADS OF INDIA.

By

J. F. Caius, S.J., F.L.S. (Deceased)

The STERCULIACEÆ are herbs, shrubs or trees, sometimes lianes, which belong to tropical and subtropical regions. There are 660 species, distributed into 48 genera.

They contain an abundant mucilage, combined in the old bark of the woody species with a bitter astringent extractable matter, and exhibit stimulant and emetic properties. Many yield gums which in their appearance resemble tragacanth, and are reputed tonic. The fruit is often astringent and antidysenteric. The seeds may be diuretic and have a stimulating effect on the central nervous system.

Among the products isolated we may mention :—(1) *glucosides*—kolatin—; (2) *tannins*—kolatannin—; (3) *gums*; (4) *alkaloids*—caffeine, theobromine—; (5) *acids*—tartaric—; (6) *amino-acids*—asparagin—; (7) *fats* and *carbohydrates*.

The medicinal and poisonous Sterculiads of the world belong to 23 genera :—Abroma (tropical Asia to Australia); Buettneria (tropical); Cola (Africa); Dombeya (Africa, Madagascar); Eriolaena (Indomalayan); Fremontia (California); Guazuma (tropical America); Helicteres (tropics, except Africa); Hermannia (tropical and subtropical, chiefly Africa); Kleinhovia (tropical Asia); Leptonychia (tropical Africa and Asia); Mahernia (Africa); Melochia (tropical); Myrodia (tropical); Pentapetes (Indomalayan); Pterocymbium (Burma, Malaya); Pterospermum (tropical Asia); Pterygota (tropical); Scaphium (Burma, Malaya, Borneo); Sterculia (tropical); Tarrietia (Eastern Asia, Australia); Theobroma (tropical America); Waltheria (tropical America).

The medicinal and poisonous Sterculiads of India belong to 16 genera :—Abroma, Buettneria, Eriolaena, Guazuma, Helicteres, Kleinhovia, Melochia, Pentapetes, Pterocymbium, Pterospermum, Pterygota, Scaphium, Sterculia, Tarrietia, Theobroma, Waltheria.

A. Flowers unisexual; petals none; stamen-column with anthers on the apex, clustered or in a ring.
  I. Ovarian cells 1-ovuled; fruit of thick samaras with foliate wings ... ... Tarrietia.
  II. Ovary with 2 or more ovules in each cell; fruit dehiscent
    1. Radicle remote from the hilum. Follicles coriaceous or woody ... ... Sterculia.
    2. Radicle next the hilum.
      a. Follicles woody. Seeds many, winged at the apex, albuminous ... ... Pterygota.

b. Follicles membranous, opening long before maturity.
  i. Calyx small, lobes lanceolate; follicles very large, green, one seed at base of each ... ... Scaphium.
  ii. Calyx campanulate; 2 seeds in each follicle ... ... Pterocymbium.

B. Flowers bisexual.
  I. Petals deciduous; stamen-column bearing a cup edged with anthers and staminodes, 5 to 15.
    1. Shrub; flowers pink, capsule membranous inflated ... ... Kleinhovia.
    2. Shrub; flowers purple or white; capsule woody not inflated; seed not winged ... Helicteres.
    3. Trees; flowers large, white; capsule woody, large; seed winged ... ... Pterospermum.
  II. Petals deciduous; stamen-column tubular, conical, antheriferous for nearly its whole length; staminodes none. Capsule ovoid, woody or coriaceous ... ... Eriolaena.
  III. Petals persistent; anthers 10 to 20 on the tip of a cup on the column. Bracteoles caducous. Herb; petals red ... ... Pentapetes.
  IV. Petals marcescent, flat. Stamen column tubular at the base only; stamens 5; staminodes none.
    1. Shrubby herb or shrub; capsule 5-celled; flowers pinkish ... ... Melochia.
    2. Shrubby; capsule 1-celled, 1-seeded; flowers yellow ... ... Waltheria.
  V. Petals concave at the base; stamen-column tubular; anthers marginal, solitary or in groups between the staminodes.
    1. Fertile stamens 5 opposite the sepals ... Theobroma.
    2. Stamens uniseriate.
      a. Anthers solitary between each staminode. Petals clawed with 2 lateral lobes and a long appendage. Climber ... ... Buettneria.
      b. Anthers 2-4 between each staminode.
        i. Petals with a stipitate ovate blade. Capsule turbinate, membranous ... Abroma.
        ii. Petals with a linear bifid blade. Capsule oblong, woody, tubercled. Flowers yellow ... ... Guazuma.

Abroma.

The genus consists of 10 species spread over tropical Asia and distributed to Australia.

A. augusta Linn. *fil.* is used medicinally in Indo-China and in the Philippine Islands. In the latter country *A. alata* Blanco is also credited with therapeutic properties.

Abroma augusta Linn. *fil.* is found indigenous or cultivated throughout the hotter parts of India, Java, the Philippine Islands, and China.

In Lakhimpur, Assam, the bark is used for sores. A part of the root is used internally and externally by the Santals to cure abscess.

The root bark has long been used in Bengal as an emmenagogue. As far back as 1873, Thornton wrote in the *American Journal of Medical Science* (p. 276): '*The fresh viscid juice* of the root-bark is useful in the congestive and neuralgic varieties of dysmenorrhoea; it regulates the menstrual flow and acts as an uterine tonic.'

In the *Indian Medical Gazette* of May 1900, Sircar reported as follows:—

'Forty years ago I first came to know the medicinal properties of this indigenous plant as a good emmenagogue in menstrual disorders. . . . The official part of the plant is the fresh viscid sap, which abounds in the thick easily separable bark of the root and is insoluble in water. . . . Attempts have been made to administer the drug in the more acceptable forms of tincture, pill or powder, *but none prove so efficacious as the fresh viscid sap in substance*, in which form I have used it with wonderful results.'

On analysis, Chopra, Ghosh and Chatterjee obtained from the root-bark a mixed oil, resins, an alkaloid—in minute quantities—, and water-soluble bases. The alkaloid and the various other fractions were then 'passed through pharmacological tests, but no remarkable activity was manifested on the gastro-intestinal tract, circulation, respiration, etc., nor was there any marked effect on the uterus whether virgin or pregnant, isolated or *in situ*. In the absence of any signs of physiological activity, clinical trials were not carried out.'

It was left to K. C. Bose to solve the problem satisfactorily. 'The root-bark is an emmenagogue and uterine tonic. The action of the dried root as well as the sap of the fresh root, has been studied in my laboratory. It showed a tonic contractile action on the uterus and its use is, therefore, indicated before the menses, to help the uterine contractions to bring about a proper flow of menstrual blood. The active principle of the drug is totally destroyed if mixed with alcohol or any other preservative; either the fresh root-bark or dried root-bark should be used.'

Assam: Gunakhiakarai—; *Bengal*: Olatkambol, Ulatkambal, Ulutkambal—; *Bombay*: Olatkambol—; *Canarese*: Melpundigida; *Ceylon*: Ulatkambal—; *English*: Devil's Cotton—; *French*: Abrome—; *German*: Abrome—; *Hindi*: Kumal, Ulatkambal, Sanukapashi—; *Indo-China*: Bom vang, Tai meo—; *Philippines*: Anabo—; *Tagalog*: Anibog, Anibong—; *Tamil*: Sivapputtutti—; *Uriya*: Pisachogonjai—.

BUETTNERIA.

The genus consists of 60 species inhabiting the tropics; mostly American, a few Asiatic and African.

Buettneria herbacea Roxb. occurs in the Western Peninsula, Orissa, the Northern Circars, the Deccan, the Carnatic, and the Konkan.

The rootstock is ground and rubbed on swellings of the legs by the Kols. It is used in combination with Bael fruit, hesel gum, and Banyan root in cholera and diarrhoea. It is given in the female complaint known in Santali as 'prodhol' (Campbell).

Kolami: Idel sanga—; *Porebunder*: Adbaubal, Vagdaubal—; *Santali*: Deku sindur—.

ERIOLAENA.

The genus consists of 8 Indo-Malayan species.

Eriolaena quinquelocularis Wight is found in the Bombay Presidency: Konkan, Western Ghats, Deccan, Southern Maharatta Country; in the Madras Presidency: Deccan, the Sandur Hills of Bellary, the hills of Coimbatore, the Western Ghats from Mysore to Travancore at 2,000-4,000 feet.

A poultice made of the roots is said to heal wounds.

Bombay: Budjari-dha-mun;— *Chota Nagpur*: Bhawat—; *Canarese*: Gomajjige, Kattale—; *Konkan*: Bujaridamu—; *Malayalam*: Vetinar—; *Mundari*: Bunduddaru—; *Tamil*: Malamtutti, Nayunnu, Vattanunnu—.

GUAZUMA.

The genus consists of 5 species, natives of tropical America.

G. ulmifolia Lam. is used medicinally in Colombia, Brazil, and La Reunion.

Guazuma tomentosa H. B. and K., a native tropical America, is found frequently cultivated in India.

The bark is tonic and demulcent, and is used with benefit in some of those cases in which calumba and gentian are indicated (Moodeen Sheriff).

The inner bark is esteemed as a remedy for elephantiasis in the West Indies; the infusion of the old bark is considered sudorific, and useful in cutaneous diseases and diseases of the chest.

In Mauritius the fruit is used as a pectoral in cases of bronchitis.

Bengali: Nipaltunth—; *Deccan*: Bandog—; *Canarese*: Bucha, Rudrakshi—; *Ceylon*: Patti-parutti—; *English*: Bastard Cedar, Honey Fruit Tree, Musket Tree—; *Honduras*: Bay Cedar—; *Malayalam*: Rudraksham—; *Mauritius*: Caca poule, Orme pyramidale, Thain pachai—; *Sinaloa*: Guasima—; *Tamil*: Rudrasam, Tenbachai, Tengai, Tubakki, Uruttiracham—; *Telugu*: Rudraksha, Udrikpatta—; *Tulu*: Rudrakshi—; *Uriya*: Debodaru—.

HELICTERES.

The genus consists of 40 species, distributed over the tropics of both worlds.

The following species are used medicinally in Indo-China and the Philippine Islands—*H. Isora* Linn.—; in Brazil—*H. brevispira* A. Juss., *H. corylifolia* Nees and Mart., *H. ovata* Lam., *H. Sacarolha* A. Juss., *H. Vuarame* Mart.

Helicteres Isora Linn. is rarely found in open country; it occurs in the dry forests throughout Central and Western India, and from the Punjab and Bengal to Ceylon and Burma. It is distributed to Malaya, Australia, and the West Indies.

The juice of the root is said to have a beneficial effect in empyema and stomach affections. In the Konkan it is used in diabetes, and is a favourite cure for snake-bite.

The bark is used in diarrhoea and dysentery.

The fruits are made into a liniment for sores of the ear, and they are administered internally for colic. They are demulcent, mildly astringent, and useful in the griping of bowels and flatulence of children.

The Santals credit the root, the bark, and the fruit with the same therapeutic properties: demulcent, expectorant, astringent to the bowels, a cure for scabies when applied topically.

The fruit, under the name of Chabei Pintal, is sold as a drug in the shops of Malaya.

A decoction of the leaves is used as an enema in Jamaica.

Mhaskar and Caius have shown experimentally that neither the bark nor the root is an antidote to snake venom.

Arabic: Altwa-al-latu—; *Banwara*: Anteri—; *Bengal*: Antamora, Antomura, Atmora—; *Berar*: Marorphal, Muradsheng—; *Betul*: Aitha, Aithi—; *Bombay*: Kawun, Kevana, Kewan, Khiran—; *Burma*: Khungiche, Thuguaykhyae, Thungeche—; *Canarese*: Bhutakarulu, Edamuri, Kadukalnaru, Kaiyuri, Kavargi, Murudi, Narukolu, Thunshulla, Yadamuri, Yedamuri—; *Central Provinces*: Boltuka—; *Ceylon*: Kawa, Vullum-puri—; *Deccan*: Dhameenee, Dhamni, Kevan, Kewanne, Maradsing, Marorikephalli—; *Godaveri*: Itah—; *Gond*: Aita—; *Gujerati*: Murdasing—; *Haldwani*: Benwa—; *Hindi*: Bhendu, Jonkaphal, Kapasi, Maraphal, Maraphali, Marorephalli, Marorphal, Marorphali, Marosi, Merosi, Murad, Muradsing—; *Indo-China*; Cay do tron—; *Kharwar*; Aita, Aitem, Aiteni—; *Khond*: Kavali, Korajbothi, Pitabaranda—; *Kolami*: Goinr, Potoporla, Renta, Sakomsang, Sinkari—; *Konkani*: Kivani—; *Khmaon*: Marorphal—; *Kurku*: Korajbothi, Koributa—; *Lambadi*: Moldaphaliro—; *Malay*: Mori—; *Malayalam*: Ishvaramuri, Kaivalanara, Kaiyuna, Valampiri—; *Marathi*: Kewan, Muradsing—; *Matheran*; Dhamni, Kewan, Muradsing—; *Monghyr*: Ainthiadhamin—; *Mundari*: Rantadara, Rentadaru—; *Nimar*: Aitha, Aithi—; *North-Western Provinces*: Bhendu, Marorphal—; *Persian*: Kishtburkisht, Pechaka—; *Porebunder*: Anted, Antedi—; *Punjab*; Kupasi, Marorphali—; *Saharanpur*: Kapasi—; *Sanskrit*: Avartani, Mrigashinga—; *Santal*: Petcamra, Petchamra—; *Sind*: Vurkatee—; *Sinhalese*: Liniya, Liniyagass, Zimiagaha—; *Tamil*: Vadampiri, Valamburi, Valampuri, Valumberi—; *Teheran*: Pachman-i-puh—; *Telugu*: Adasamanti, Adasyamali, Gubadarra, Gubalada, Kavanchi, Nulitada, Nuliti, Peddasamanti, Sadala, Samanti, Syamali, Tada, Uttrasi, Valambiri—; *Tulu*: Kaiycli, Muriga—; *Urdu*: Marorphali—; *Uriya*: Murmuria Orola, Kaval, Modimodi, Murimuri.

KLEINHOVIA.

K. Hospita Linn., the sole representative of the genus, inhabits the tropics of both hemispheres. It is found in the Eastern and Western Peninsulas of India, and distributed to Malacca, Singapore, Ceylon, Java, the Philippine Islands, and East Tropical Africa.

A decoction of the leaves is used in the Philippine Islands as a remedy for scabies, and as a lotion for cleaning skin eruptions.

Ilocano: Bignon, Bitnog, Bitnong—; *Indo-China*: Tra—; *Pampangan*: Panampat—; *Philippines*: Bitang, Bitnon, Pampar—; *Sunderbuns*: Bhola—; *Tagalog*: Tan-ag—; *Visaan*: Hamitanaga, Tan-ag—.

MELOCHIA.

The genus consists of 65 tropical species.

M. borbonica Cav. is used medicinally in La Reunion, *M. pyramidata* Linn. in Mauritius.

Melochia corchorifolia Linn. is found in the hotter parts of India from Kumaon to Sikkim and the Malacca Peninsula; in Cutch

Gujerat, the Konkan, and North Kanara; in most of the districts of the Madras Presidency, and in Ceylon.

The whole of this plant, with the exception of the root, boiled in oil, is supposed on the Malabar Coast to be an efficacious remedy for preventing bad consequences from the bite of a water snake (Ainslie).

Water snakes are harmless (Caius).

Bengal: Tikiokra, Tikiopra—; *French Sudan*: Togoyo—; *Fulani*: Tukurra—; *Hausa*: Tukurra—; *Hindi*: Bilpat—; *Malay*: Lumah ketam; *Malayalam*: Seruvuram—; *Mende*: Ndopa-yengei, Ngengele—; *Mundari*: Dela ara, Delka ara—; *Philippines*: Calingan—; *Santali*: Thuiakarak—; *Sinhalese*: Hingalkara, Kingalkara—; *Sokoto*: Tukurra—; *Susu*: Suri—; *Tamil*: Chiraparam, Pinnakkuppundu, Punnakkukkirai—; *Telugu*: Ganugapindikura, Sittantakura, Tutturubenda—; *Timne*: Kirkinkirin-Kobanabana—; *Uriya* Chyeron, Dasokerotan, Nolita—; *Wolof*: Pag hou gor—.

PENTAPETES.

The only representative, *P. phoenicea* Linn., is indigenous in North-Western India, Gujerat, and Bengal. It is distributed to Malaya, Java, the Philippine Islands, and China.

The fruit is mucilaginous. The root is employed as a medicine by the Santals. The plant is used as an emollient in Annam and in China.

The Chinese use the plant in indigestion and in atony of the stomach.

Bengal: Bandhuli, Doopahuria, Katlala—; *Chinese*: Ou Che Hoa, Ou Ts'ai Hoa—; *Gujerati*: Duporio, Sowbhagyasundari—; *Hindi*: Dopaharia, Daparia, Dopohoria—; *Indo-China*: Da lac kim tien, Hoa ti ngo, Ngo thi tra—; *Marathi*: Tambridupari—; *Punjab*: Guldupaharia—; *Sanskrit*: Arkavallabha, Bandhujiva, Bandhujivaka, Bandhuka, Bandhula, Bandhura, Haripriya, Jvaraghna, Madhyadina, Madhyanika, Oshthapushpa, Pushparakta, Rakta, Raktaka, Raktapushpa, Saratapushpa, Supushpa, Suryabhaka—; *Santal*: Barebaha—; *Tamil*: Nagappu—.

PTEROCYMBIUM.

The genus consists of 2 species, natives of Burma, the Nicobars, and Malaya.

Pterocymbium javanicum R. Br. is found in the open forests of Malaya by creeks or open woodland. It is distributed to Burma, Nicobars, Java, and Philippines.

The tree yields a gum which is a fair substitute for tragacanth.

Burma: Tshaw—; *Malay*: Kluet, Kulunot—.

PTEROSPERMUM.

The genus consists of 20 species, natives of tropical Asia.

A. Bracteoles linear, entire, very caducous. Leaves 5-15 by 2.5-5 cm. ... ... *P. suberifolium.*

B. Bracteoles laciniate or palmately divided.

  1. Leaves 25-35 by 15-30 cm. ... ... *P. acerifolium*
  2. Leaves 10-15 by 5-9 cm. ... ... *P. heyneanum*

1. **Pterospermum acerifolium** Wild. is found in the sub-Himalayan tract and outer Himalayan valleys and hills up to 4,000 feet, from the Jumna easterwards to Bengal, Chittagong, and Burma. It is extensively planted in the Bombay Presidency.

The down on the leaves is used by the hill-people in Sikkim to stop bleeding in wounds.

In the Konkan the flowers and bark, charred and mixed with kamala, are applied in suppurating small-pox.

The flowers are used as a general tonic. They are employed by Bengalis as a disinfectant and to keep insects away from bed clothes. They are also said to render water gelatinous.

Bengal: Kanakchampa, Muchokunda, Mus—; *Bombay*: Kanakchampa, Karnikara—; *Burma*: Tha-ma jam wai-soke, Toungpetwun—; *Canarese*: Kanakachampaka, Rajataru—; *Hindi*: Kanakchampa, Kanier, Kathachampa—; *Jaunsar*: Mayeng—; *Kachin*: Magwi napa—; *Kolami*: Muchukundi—; *Konkani*: Kanokchampo—; *Lepcha*: Numbung—; *Magahi*: Gaik—; *Michi*: Laider—; *Mundari*: Makcunddaru—; *Nepal*: Hattipaila—; *Philippines*: Bayoc—; *Sanskrit*: Karnikara, Mushukunda, Padapotpala, Parivyadha—; *Santali*: Machkunda—; *Tamil*: Vennangu—; *Telugu*: Matsakanda—; *Tharu*: Machkan—; *Uriya*: Konokochompa, Mushukundo.

2. **Pterospermum heyneanum** Wall. occurs in the Western Peninsula.

The leaves are used in leucorrhoea; they are smoked like tobacco.

Khond: Baili—; *Tamil*: Polavu—; *Telugu*: Duddika, Loluga, Machchakanda, Nolika—; *Uriya*: Bailo, Giringa, Machkunda—.

3. **Pterospermum suberifolium** Lam. is found in the Northern Circars, and Carnatic. It is sometimes planted in the Bombay Presidency.

The flower rubbed into paste with rice vinegar is an ancient and well known application for hemicrania. It is said to render water gelatinous.

Bengal: Muchkand, Muchukunda, Muskunda—; *Bombay*: Muchunda, Muchukunda—; *Burma*: Naji—; *Canarese*: Muchukunda—; *Ceylon*: Tada, Toddi, Vinanku, Vinnaku—; *Hindi*: Muchkand—; *Konkani*: Munchund—; *Marathi*: Muchkund—; *Sanskrit*: Arghyarhalakshanaka, Bahupatra, Chitraka, Dirghapushpa, Harivallabha, Kshatravrikha, Muchukunda, Mundivrikshanukaraka, Prativishnuka, Raktaprasava, Sudala, Supushpa—; *Sinhalese*: Velanga, Velenge, Venangu—; *Tamil*: Sembolavu, Sittilaipolavu, Tadai, Vennangu—; *Telugu*: Lolagu, Narudu, Tada—; *Uriya*: Baelo, Giringa, Guputi, Gureno—.

PTERYGOTA.

The genus consists of 4 palaetropical species.

Pterygota alata R.Br. (=*Sterculia alata* Roxb.) occurs in the Western Peninsula, Sylhet, Chittagong, Pegu, and Martaban down to Tenasserim. It is also found on the Andamans.

In Sylhet the seeds are used as a substitute for opium.

Assam: Tula—; *Burma*: Letkope—; *Canarese*: Bekaro, Jaynkatala—; *Chittagong*: Buddhanarikella—; *Malayalam*: Anattonti, Porila, Porutonti—; *Tamil*: Anaittondi, Kodaittondi—.

SCAPHIUM.

The genus consists of 4 species found in Martaban, the Malay Peninsula, and Borneo .

Leaves 15-20 by 10-12.5 cm. ... ... 1. *S. affine.*
Leaves 30-35 by 15 cm. ... ... 2. *S. Wallichii.*

1. **Scaphium affine** Ridley is fairly common in the forests in the south of the Malay Peninsula.

The fruit acts as a demulcent.

The seed, immersed in water for a night, exudes a gum, containing bassorin, to such an extent as to fill a small cup. This, mixed with sugar-candy, is eaten as a stomachic, and is very pleasant and wholesome.

Malay : Kembang semangkok, S'ilayer—.

2. **Scaphium Wallichii** Schott and Endl. (=*Sterculia scaphigera* Wall.) is common in the tropical forests along the eastern and central slopes of the Pegu Yomah and Martaban. It is also found in Chittagong, Tenasserim, and Malacca.

The fruit is used in China as a remedy for piles and dysentery, and for diseases of the lungs and the kidneys.

In Cambodia, Siam, and Malaya the fruit is macerated in water, when the outer shell or pericarp increases enormously in volume forming a large gelatinuous mass. The jelly is sweetened and eaten as a delicacy, and is said to be a specific in diarrhoea and dysentery.

Chinese : Ta Hai—; *Malaya* : Kembang semangkok, Tai hoi—; *Siam* : Bungtalai—.

STERCULIA.

The genus consists of 100 tropical species.

Many of the species yield gums in considerable quantity, most of which resemble tragacanth in their appearance and properties.

The following are used medicinally in Japan—*S. javanica* R.Br.—; in the Philippine Islands—*S. Balanghas* Linn., *S. foetida* Linn., *S. oblongata* R.Br., *S. rubiginosa* Vent, *S. stipularis* R.Br., *S. urens* Roxb.—; in Indo-China—*S. hypochroa* Pierre, *S. lychnophora* Hance, *S. platanifolia* Linn., *S. foetida* Linn., *S. Thorelii* Pierre—; in China—*S. platanifolia* Linn.—; in West Africa—*S. tomentosa* Guil. and Perr., *S. Tragacantha* Lindl.—; in Australia—*S. acerifolia* A. Cun., *S. diversifolia* G. Don., *S. rupestris* Benth.—; in Brazil—*S. chicha* St. Hil., *S. striata* A.St.Hil. and Naud.—.

A. Leaves digitate ... ... *S. foetida.*
B. Leaves palmately lobed ... ... *S. urens.*
C. Leaves simple, not lobed, 1-nerved.
  Calyx-lobes narrow, incurved, frequently cohering at the tips, gaping at the sides.
    1. Leaves pubescent beneath ... ... *S. Balanghas.*
    2. Leaves with the nerves rusty-hispid beneath. *S. rubiginosa*

1. **Sterculia Balanghat** Linn. is found throughout the hotter parts of India, on the coasts of Tenasserim, in Ceylon, and the Andaman Islands.

In the Philippines the fruit is considered cooling and laxative.

French: Bois de cavalan—; *Malayalam*: Kavalam—; *Philippines*: Balan ghas—; *Sinhalese*: Nawa—.

2. **Sterculia foetida** Linn. occurs in the forests of Western and South India at low elevations. It is also found in Burma, Ceylon, and the Malay Peninsula. It is distributed to East Tropical Africa, the Philippine Islands, and North Australia.

The oil from the seeds is a mild laxative and is used as a carminative. The seeds when swallowed incautiously bring on nausea and vertigo.

The leaves are repellent and aperient.

A decoction of the fruit is mucilaginous and astringent.

In Java the fruit is employed in gonorrhoea.

Bombay: Junglibadam, Pun—; *Burma*: Hlyampyu, Letkok, Shawbyu, Showbju—; *Canarese*: Bhatala, Bhutaili, Gotinakayi, Jaynkatala, Jenukayitaili, Kuduregotu, Penari—; *Ceylon*: Kaditeni, Pinari—; *French*: Arbre puant, Bois caca, Bis Bois de cavalam, Bois de merde, Bois puant—; *Goa*: Junglibaddam, Kuomhad, Virhoi—; *Hindi*: Jangalbadam, Janglibadam—; *Ilocano*: Bangar—; *Indo-China*: Chim chim rung, Trom—; *Jolo*: Caumpang—; *Konkani*: Cunyemruc, Viroi—; *Malay*: Kelompang—; *Malayalam*: Pinari, Pottakavalam—; *Marathi*: Goldaru, Janglibaddam, Nagalkuda—; *Muduva*: Kaludaivitte—; *Pampangan*: Calumpan—; *Portuguese*: Puna, Puna bastarda—; *Pulaiya*: Kesalamaram—; *Sinhalese*: Telambu—; *Tagalog*: Calompan, Calumpag, Calumpang—; *Tamil*: Arali, Attirappidukkan, Kudiraippidukku, Malaittengai, Pinari, Pudagarappanbattai—; *Telugu*: Guttapubadamu, Manjiponaku, Piyyattiponaku—; *Tulu*: Pinari—; *Visayan*: Bobag—.

3. **Sterculia rubiginosa** Vent. is common in woods in open country in Burma and the whole of the Malay Peninsula from Singapore to Penang. It is distributed to Cochin-China, Java, and Sumatra.

The fruit is used as a mild laxative.

Malay: Dundanak, Saburu, Sakelat, Unting-unting besar—; *Tagalog*: Nato—.

4. **Sterculia urens** Roxb. occurs in North-Western India, Assam, Behar, the Eastern and Western Peninsulas, and Ceylon.

The leaves and tender branches steeped in water yield a mucilaginous extract, useful in pleutro-pneumonia in cattle.

The gum, known as *karai-gond*, is used as a substitute for tragacanth in Bombay.

The Santals consider the gum a useful medicine in throat affections.

In Philippines the root bark is pounded, made into a poultice, and applied to wounds, and fractures; it is also used in orchitis.

Ajmere: Kalru, Katila—; *Assam*: Hatchanda, Odla—; *Banda*: Kulu—; *Berar*: Guru, Kairu, Karai, Kulu, Taklej—; *Betul*: Guru, Karai, Kulu—; *Bombay*: Gular, Gulu, Gwira, Kadai, Kandai, Kando, Kandol, Kandula, Kawalee, Kullin, Kulu, Pandruka, Sardol, Sardora—; *Canarese*: Bhutali, Kempudaili, Kempudala, Kempudale, Pinari, Punike—; *Central Provinces*: Gulu, Gurlu, Karhar, Kulu—; *Ceylon*: Kavali—; *Deccan*: Kurdu—; *French*: Sterculia démangeant, Touroutier—; *Gond*: Hittum, Pinoh—; *Gujerati*: Kada, Kagdol, Karai—; *Hindi*: Bali, Gular, Gulu, Kabru, Karrai, Katira, Kuli, Kulu, Tabsi, Tanuku—; *Jeypore*: Kaddu, Karr—; *Khandesh*: Kud—; *Khawar*:

Kaunji—; *Khond*: Gauduli, Gendule—; *Kolami*: Feley, Kaunji, Teley—; *Konkani*: Pandruk—; *Kurku*: Takli—; *Malayalam*: Tonti—; *Manbhum*: Keonge—; *Marathi*; Gwira, Kandol, Kandula, Karai, Kavali, Pandruka, Soldawar—; *Matheran*: Bandruk, Kaoli, Kuari, Sardol—; *Melghat*: Teklej—; *Merwara*: Kor—; *Monghyr*: Kanaunji, Karaunji, Mogul—; *Mundari*: Burkunda, Gurkaranj, Makchund—; *Nimar*: Guru, Karai, Kulu—; *North-Western Provinces*; Gulli, Kuli—; *Panch Mahals*: Kalauri—; *Porebunder*: Kadai, Kadayo—; *Santali*: Telhec'—; *Tagalog*: Banilad—; *Tamil*: Kavalam, Puttali, Sendalai, Sendanakku, Sigapputtanakku, Tanakku, Vellaipputtali—; *Telugu*: Ettaponaku, Kavali, Kavili, Ponaku, Tanuku, Tapasi—; *Uran*: Keunji—; *Uriya*: Girungilia, Gudalo, Kavili—; *Visayan*: Banilad—.

TARRIETIA.

The genus consists of 7 species inhabiting Malaya, Cochin-China, and Australia.

Tarrietia unifoliolata Ridl. occurs in Malacca. The plant is used medicinally by the Malays.

Malay: Kamuning hutan—.

THEOBROMA.

The genus consists of 20 species, natives of tropical America.

The seeds are analeptic. They yield a fixed oil known as 'oil of Theobroma' or 'Cacao Butter', and they are extensively used for the extraction of the alkaloid 'theobromine'.

The species used are all originally South American: *T. bicolor* H. and B., *T. Cacao* Linn., *T. glauca* Krst., *T. martiana* D. Dietr., *T. macrantha* Bernoulli. *T. microcarpum* Mart., *T. syvestris* Aubl.—

Theobroma Cacao Linn. has long been introduced into India, and is cultivated in the Southern Presidency and Ceylon.

A light yellowish, opaque, solid oil, known as 'Cacao butter', is prepared for use in pharmacy, by pressing the warmed seeds. It is officinal in the pharmacopœcias of Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Japan, Mexico, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, United States, Yugoslavia.

The seeds contain from 1.5 to 2.4 per cent theobromine.

Ceylon: Chocolathgas, Cocomaram—; *Dutch*: Cacaoboom, Kakauboom—; *English*: Cacao, Chocolate Tree, Cocoa—; *French*: Cabasse, Cabosse, Cacao, Cacaotier, Cacaoyer—; *German*: Kakaobaum—; *Guam*: Kakao—; *Hungarian*: Kakao, Kokuszfa—; *Italian*: Albero del Cacao, Cacao—; *Mexican*: Cacacoatl—; *Portuguese*: Cacao—; *Roumanian*: Cacaotier—; *Russian*: Kakaovoi derevo—; *Spanish*: Arbol del cacao, Cacao, Haba de Mejico—; *Swedish*: Kakao—; *Turkish*: Kakao—.

WALTHERIA.

The genus consists of 30 species, mostly American.

W. Douradinha A. St. Hil. is used medicinally in Brazil.

Waltheria indica Linn. is a widely diffused tropical weed, common in all the hotter parts of India, from Kumaon at 4,000 feet to Malacca and Ceylon.

In Mauritius the plant is credited with emollient and bechic properties, and is used as a cough medicine.

In West Tropical Africa the plant is a common medicine for infants. In Northern Nigeria the infant is given to drink or to sniff or inhale a decoction of the root boiled along with native natron. In Yoruba and in Togo the plant is a constituent of various infusions, both to drink or as wash for a few weeks to strengthen the child's resistance against fevers and other troubles.

Amongst the Hausas the root is considered to be purgative; also a decoction of the plant is believed to be a preventive of syphilis, and, if taken frequently, to afford immunity. It is also drunk by agriculturists as a restorative during the labours of harvesting.

In Togo a spoonful of the pulverised plant with hot water is taken morning and evening as a cough medicine.

In Gold Coast the plant is used to cause abortion.

The Thangaan women take a decoction of the root for barrenness.

The Sutos either chew the raw root or drink a decoction of it for internal haemorrhages.

Bambara : Dabada—; *Fulani* : Kafaffi, Kapappi—; *Ga* : Fufunoba, Nansuru—; *Gbari* : Nyiknapmiyaya—; *Hausa* : Hankufa, Yankufa—; *Malinke* : Bourai—; *Mauritius* : Guimauve, Guimauve créole, Toutti—; *Mende* : Ngala-yuyui—; *Shangaan* : Simbongana—; *Suto* : Lexutasela—; *Telugu* : Nallabenda—; *Togo* : Adu weti, Bati—; *Twi* : Apem—; *Uriya* : Bojoromuligna—; *Wolof* : Bourai—; *Yoruba* : Korikodi, Opa-emere—.

MORE ABOUT THE FLAMINGO [*PHOENICOPTERUS RUBER ROSEUS* (PALLAS)] IN KUTCH.

BY

SALIM ALI.

(*With 2 plates.*)

When Mr. C. McCann visited the 'Flamingo City' in the Great Rann in October 1935 the nesting season was unfortunately almost over. There were evidently no fresh eggs, or eggs being brooded, at the time and most of the adult birds seemed to have left. What he was chiefly able to see was a large number of non-flying young birds in various downy and juvenile stages. His interesting account, published in Vol. xli of the Journal (August 1939, pp. 12-38) is a useful contribution to our knowledge of this species.

When I first visited the nest 'city' eight years later (in October 1943) I had even worse luck. It had been reported earlier in the season that large concentrations of flamingoes—'7 to 8 thousand'—had been observed in that area. As the monsoon had been favourable, and water conditions in the Rann after a series of drought years at last seemed as required, it was confidently expected that the birds would breed. Some unfavourable factors appear to have intervened, however, for when I visited the nest 'city' later on, during the first week of October, the water had receded a long way leaving the nests high and dry. From the desiccated condition of the ground surrounding the nests it was evident that the water had been gone a month or more. The clear imprints of flamingoes' feet around and in among the nests, the fresh 'scoops' in the mud when it must have been wet, and the partial replastering of old nest mounds showed that the birds had certainly been there when the place was inundated and had commenced to rehabilitate the deserted 'city'.

The following monsoon (1944) was a particularly heavy one. The nesting grounds were apparently immersed in such deep water until December or January that no nesting by the birds would have been possible, and it looked as though the birds would have to skip yet another season. It seemed rather extraordinary, however, that they should miss season after season and apparently fail to reproduce altogether for so many consecutive years. And it seemed worthwhile to determine whether, given favourable conditions, the flamingo may not breed at a different season to what was so far known. Here was the opportunity. At my suggestion, and with his characteristic keenness, His Highness Maharao Vijayarajji very kindly arranged to have the relevant area of the Great Rann suitably patrolled for as long as any water stood there, even well after the known breeding time was past. Such a step appeared at first to be waste of time and labour, but we had not long to wait before it was proved justified. Contrary to precedents, flamingoes were reported by the patrols to be concentrated and nesting in great abundance at their accustomed spot in late March 1945, when the water level in the Rann had subsided to what it is in normal years towards the end of the monsoon season. His Highness at once despatched a reliable shikari to obtain confirmation of this unusual happening, and also sent the State photographer along to get a graphic record of the same. These men returned on 10th April with unquestionable evidence—some excellent photographs showing enormous numbers of birds at their nests, and eggs collected in the colony both fresh and in various stages of incubation. One of these eggs actually hatched out in the cardboard box in which it was kept. Upon H. H. telegraphing to me in Bombay I lost no time in arriving on the scene. Sir Peter Clutterbuck who chanced to be in Bhuj at the time, inspite of the fact that he is no longer as young as he used to be, was enthusiastic enough to face the heat and hardships of the journey and accompany me. We camped as before at Nir on the N-E tip of Pachham Island. The flamingo 'city'—the same used in successive seasons—is located directly N-E of Nir, 6 to 7 miles out in the Great Rann. It is on a dry pancake-flat 'island' which at the time of our visit was about one mile long (W to E) and about half a mile in width. To reach it one had to wade or ride through shallow water—more or less concentrated brine—ankle to thigh deep for most of the distance, interspersed here and there by other similar 'islets' whence the wind had temporarily driven off the water. The average time taken to reach the 'city' from Nir was 2 hours and 40 minutes.

The first visit to the colony was made on the morning of 19 April accompanied by Sir Peter Clutterbuck. On the 20th afternoon I visited the place again—alone this time—arriving there at 6-45 p.m. and bivouacing overnight. I left the colony at 11 a.m. on the 21st. A third visit was made on the afternoon of 22nd April which lasted till 11-30 a.m. on the following day. These notes, scrappy as they necessarily have to be from the shortness of the time at my disposal, are the result of the three visits—particularly of the last two when unhurried observations were possible, and also some during the night under a bright, nearly full moon.

Meteorological Conditions.—Temperature: Minimum (during night) 77°F; Maximum (at 11 a.m.) 116°F. Presumably considerably hotter in the afternoon. In the above instance, the thermometer stood against a nest-mound on its shady side and was not exposed directly to the sun as the eggs and young are. A newly hatched chick died when left exposed on a nest-mound for between half and one hour (about 10 a.m.).

Practically all day and all night a strong wind was blowing from NW (or NNW) to SE with often the intensity of a Moderate Gale (Force of the Beaufort scale = 28 to 33 m.p.h.) Sky clear. Visibility good in early morning, getting hazy in distance (near horizon) after sunrise. Nights clear, moonlit.

The Nest 'City': Its extent and population.—The 'city', to the nests on its extreme periphery, measured 480 yards (W to E) × 245 yards = 117,600 square yards. Sample plots were selected at random, each 10 yards × 10 yards = 100 square yards, and nests on these counted, as follows: 135, 151, 128, 110. Average 131. The result of a further independent count on the second day was essentially the same. Taking off 20% of the total area for the bald (unbuilt) patches interspersed in the middle and on the outskirts (117,600 less 23,520) leaves 94,080 square yards. Therefore total number of nests in the city 123,245.

Taking off 15% of the above for old nests and those not in use at present (123,245 less 18,487) leaves 104,758 active nests.

Counting 2 adult birds to each nest	209,516
,, say only 2 young to every 3 nests ...	69,839
Total population of the city :	279,355 birds

It seems to me more than likely that at least 2 successive broods are raised. Enormous numbers of young birds of the year were scattered in the shallow water all along the periphery of the island so that the population of flamingoes within sight in this area at present, including breeding and non-breeding adults and young in all stages, could on a conservative estimate, not have been less than about 500,000 (half a million) birds.

Food.—The question of the food of the flamingo in the Rann is naturally of great interest considering the vast population it has to support for certainly not less than 3 months in the year, and possibly much longer. Both Ticehurst in Sind and McCann in the Great Rann found seeds, mostly of aquatic freshwater or waterside plants in flamingoes' gullets and stomachs. There is so far no justification, however, for supposing that these constitute the only or indeed the staple diet of flamingo in these parts. It seems difficult to conceive that sufficient quantities of such seeds, e.g. *Ruppia,* could be washed down by the rivers flowing into the Rann from the north-east to sustain a population of this magnitude for so long a period. The matter calls for careful investigation. The stomachs of 2 adult birds shot by me in the salt pans at Kandla in September (1943) contained *ca* $\frac{3}{4}$ oz. (when dry) of grit or coarse sand (*ca* 1 mm. in diam.). In addition to this there was a small quantity of slimy greenish-brown vegetable matter like the 'scum' from the bottom of the salt pans, and a large number (over 50 in each case) of red thread-like 'worms' *ca* 10 mm. long, later identified as *Chironomus* larvae. The latter figured largely also in the stomach contents of Dunlins and other waders frequenting the salt pans at this period.

Adults.—When a bird first settles on eggs it pivots from side to side until comfortable. Birds sitting on nests, and at ease, have their back feathers (scapulars) frowzled and erected, looking like gigantic chrysanthemums! An incessant babbling 'roar'—*kakak, kaka, kākāk* etc. (of the wheezy quality of a mallard drake's quack, but louder) and goose-like gentle honks in varying keys, emanate from the nesting colony day and night. Birds not brooding stand upright beside their partners and usually have their backs to the sun. Thus from a distance the assemblage is clearly seen in two tiers, as it were, and from the side all birds appear in profile, facing away from the sun. A considerable, and almost continuous, traffic was kept up during the bright moonlit nights between the nest city and various parts of the Rann, evidently the birds foraging. Birds sitting on nests when approached, were far less loth to leave the contents exposed during the night than in the heat of the day.

When the 'city' was visited by the shikari and photographer in the first week of April, most nests contained eggs—only one each—as will be seen from the photo reproduced. In the 3rd week of April (between 20th and 23rd) single newly hatched chicks or chipping eggs predominated. Besides these there were large numbers of slightly older downy chicks running about all over the place in among the nest-mounds. A considerable number of nests, moreover, still had fresh eggs—invariably one per nest—and there were innumerable others, fresh, hard-set and addled lying helter skelter all about the colony at the base of the nest-mounds. It is difficult to say how they got there, since without deliberate effort or some degree of violence it is inconceivable they could roll off over the rim of the 'crater'. Are dislodged eggs ever retrieved? Or is a fresh egg always laid to replace the dislodged one?

Chicks.—Flamingo chicks are extremely precocious from even when little more than animated powder-puffs, a few hours old. When lying inert on top of the nest-mounds, necks stretched prone, they will attempt while the observer is still some distance away to slither down the mound and escape, shuffling along balancing themselves with their stumpy wings and waddling comically like some plump small gentleman in a hurry! It is a puzzle how the adult birds ever find their own nests and eggs and/or chicks from amongst the close-packed thousands that extended for acres. But I think that once the young have begun to run about, and confusion becomes worse confounded, and until such time as they are led out into the shallow water to fend for themselves (apparently only a matter of days) the community is run on a communistic basis, and adults feed young more or less indiscriminately. No other course seems imaginable. When the nest colony was approached, the adults gradually moved off towards the water's edge followed by a dense broad band of downy chicks, like a conveyor belt, running alongside them, in amongst and around their legs or trailing behind like scared refugees from a bombarded city. When approached closer, most of the adult birds flew off leaving only a handful of the bolder ones in charge. These were loth to desert the chicks, and only did so in the last resort, when hard pressed. Thus it was not unusual to find about 20 adult birds leading off a thickly packed jostling army of several hundred downy chicks of all ages and sizes, from those scarcely 3 or 4 days old upwards. A plausible explanation for the strongly webbed feet of the flamingo now occurs to me. Old birds use them for swimming but comparatively rarely. Their legs are long enough to enable them to wade into all the depth of water they normally require for feeding in. The baby flamingo's legs are short and he would never be able to escape enemies or forage for himself in shallow water unless he could swim. This he does remarkably well, kicking out his little legs rapidly to paddle like a duck whenever the water becomes deeper than he can conveniently run in. And he moves much faster and far less unsteadily this way than he can do on land. In the shallows he progresses just like an amphibian jeep, running along or swimming, all in his stride as the depth of the water demands. The tibia and tarsus begin to get disproportionately long at an early age; somewhat older chicks can run extremely fast and are difficult to overtake.

Enemies.—Except for a couple of Scavenger Vultures (cf. McCann also) which were observed smashing hardset eggs and leisurely devouring the contents in the interval when the birds had been scared away by our activities, I saw no enemies. A number of such eggs, smashed and with part or the entire contents devoured, presumably by the same agency, were found lying on the nest-mounds or about their base. It appears that these vultures must take a regular but not very considerable toll. From its far-lying and islanded situation the 'city' seemed to immune from four-footed enemies. Although jackals are plentiful in the hills about Nir, I saw no evidence during the time I was there of their visiting this place or of any damage that might reasonably be attributed to them. There seems no doubt that the greatest casualty among the eggs and young is due to the scorching relentless sun. The number of dead and desiccated chicks strewn about the colony I can only ascribe to this cause. An instance is given earlier on of the fatal effect of even a comparatively short exposure on a newly hatched chick. The fact that chicks, a few days old, are led away by the adult birds to the shallow water doubtless acts as a safety measure against the broiling heat of the exposed sun-baked nests. It would appear that the chicks thereafter fend for themselves and do not return any more to the nest colony to roost or be fed.

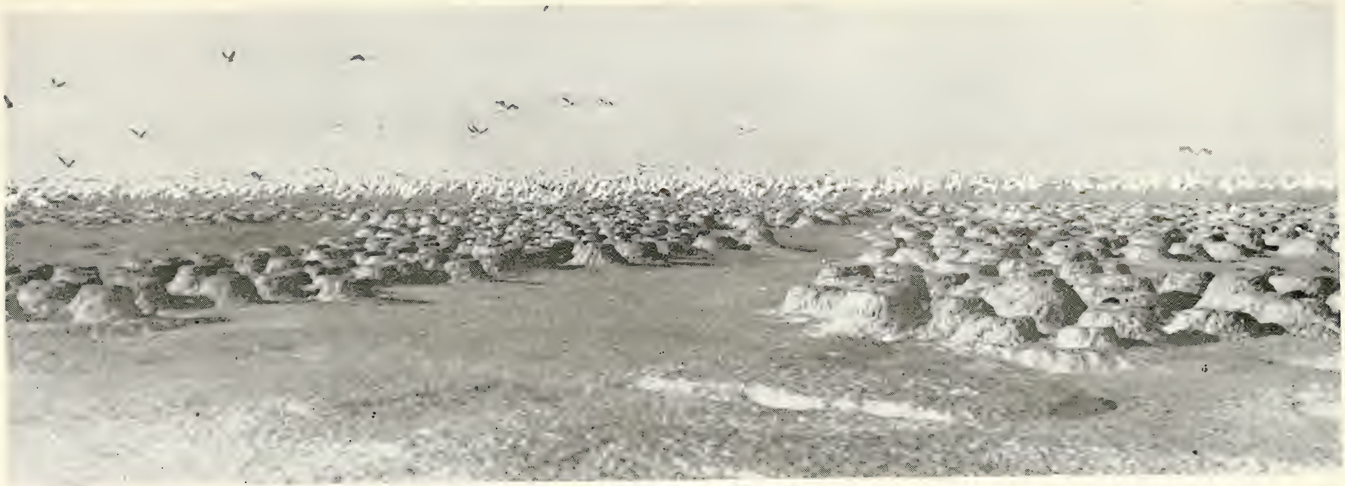
Migration and Local Movements.—The appeal published in the Journal (Vol. 44. p. 476) with a view to eliciting information on these points has so far met with poor response. We are no nearer to solving the problem of what happens to the flamingo hordes in drought years, when conditions are unsuited for their breeding on their accustomed grounds in the Great Rann. They are apparently able to breed here only once in 3 or 4 years, occasionally even longer periods.

It will be remembered that Mr. McCann by a process of jig-saw-puzzle working in of breeding seasons and dates of recorded movements in Mesopotamia, Persia and elsewhere, put forward a suggestion to the effect that Indian flamingoes perhaps normally migrated to breed in the marshes of Southern Spain, another well known breeding ground. Under favourable conditions, mainly depending on good winter rains, the nesting season there commences in May. His suggestion was that if unfavourable natural conditions were encountered in Spain the birds turned about and made for Kutch. The normal breeding season in the Great Rann being September to October, they would get ample time to do the return journey in. Then if they meet with the required conditions here, they undertake breeding. Thus the marismas of Spain and the Great Rann of Kutch would, according to him, be the erratically used alternative breeding grounds of our Indian flamingoes. Personally I did not at the time, nor do I now, find Mr. McCann's 'supposition' a convincing one, but of course it does not do to be too dogmatic in such matters, and more data are needed. Mr. McCann pertinently observes that to obtain any proof the wholesale ringing of birds in the two areas (Spain and Kutch) would be necessary. It is a pity he had no rings with him when he visited the nest city, when the opportunity for marking seems to have been good. On my recent visit (April 1945) I was fortunate in being able to mark a few young birds. Theoretically there would seem no reason why, provided one got there at the appropriate time as I did, one should not be able to ring a thousand or 5000 or even 10,000 chicks within a comparatively short time considering the immense numbers of them about. In practice, however, the matter proved to be much less simple. With the help of five active locals, ringing 192 birds is all I could do during the best part of 2 mornings. I had no more time at my disposal. For one thing young flamingoes of an age and size suitable for ringing (from about 10 days to 3 weeks old) run like stags and often require all-out sprinting to overtake. For another, the ground on which this race is run is all in the bird's favour. The surface is generously buttered with semi-liquid mud. You slither and slide and skid the whole time. Frequently when just within grasp you lunge at the quarry and suddenly find yourself on your bottom or grovelling in the mire with a perfect worm's eye view of the escaping chick. The only consolation in such a predicament is when you look round and find that half your helpers are in like case. It is exhausting work.

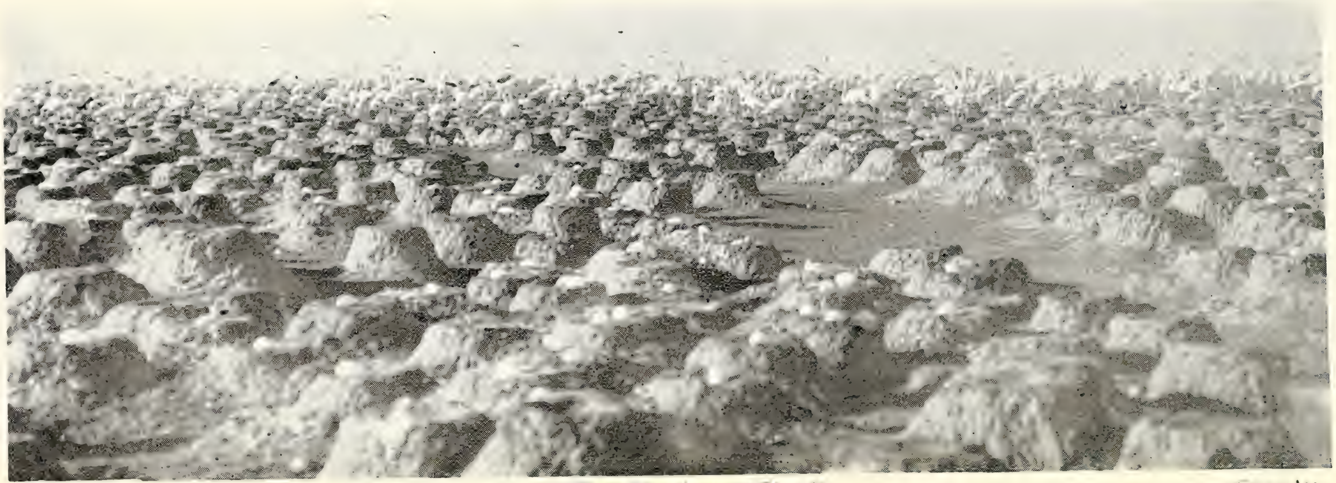
The rings used on the birds are the Bombay Natural History Society's standard duck rings No. 6036 to 6169, and 6301 to 6360. They are all attached on the bare portion of the left tibia (just above the 'knee' joint) so that they may easily be seen at a distance with field glasses. I shall be glad if any of these ringed birds seen are reported to the Society with dates and particulars.

The Photographs.—Some of the beautiful photographs that illustrate this note were taken by Ali Mohammad, the State photographer, under conditions that do him great credit and call for special mention.

At a crucial moment, on first arrival at the nest city with Sir Peter Clutterbuck, I discovered that my own camera, fitted with telephoto lens, on which I had been banking so complacently, was out of order. In response to a desperate S.O.S. to Bhuj, His Highness kindly sent out post-haste not only his own Kodak for my use, but also the State photographer with complete paraphernalia. Ali Mohammad was accompanied by a special assistant whose exact purpose or function was not apparent at the time. The 2 photographers and their equipment made up 2 complete camel loads. The apparatus—a full-plate studio camera of solid teakwood of enormous size and cumbrousness—looked very like some antique piece of furniture of the period of William the Conqueror or thereabouts. It had no shutter but worked by the doffing and donning of a cap over the lens. And after every exposure you expected the photographer to bow and say 'Thank you'. The results of his sleights-of-hand were, that even with comparatively slow plates and the diaphragm shut down to a pinpoint, the plates were somewhat overexposed. (The Weston meter showed the correct exposure to be 1/200 of a second at F 22 with Super XX film). It was obviously a camera with a history and it would not surprise me to learn that it is the same as made the original picture of the flamingo nests in the Rann, published in the *Journal* in 1896 by His late Highness Maharao Khengarji. The apparatus not only needed two men to rig it up for action, but I discovered that the focussing was also a highly complicated cooperative business. It was worked like a ship, and this is where the trained assistant came



1. The Flamingo "City."



2 The Flamingo "City."

Photos by SALIM ALI.

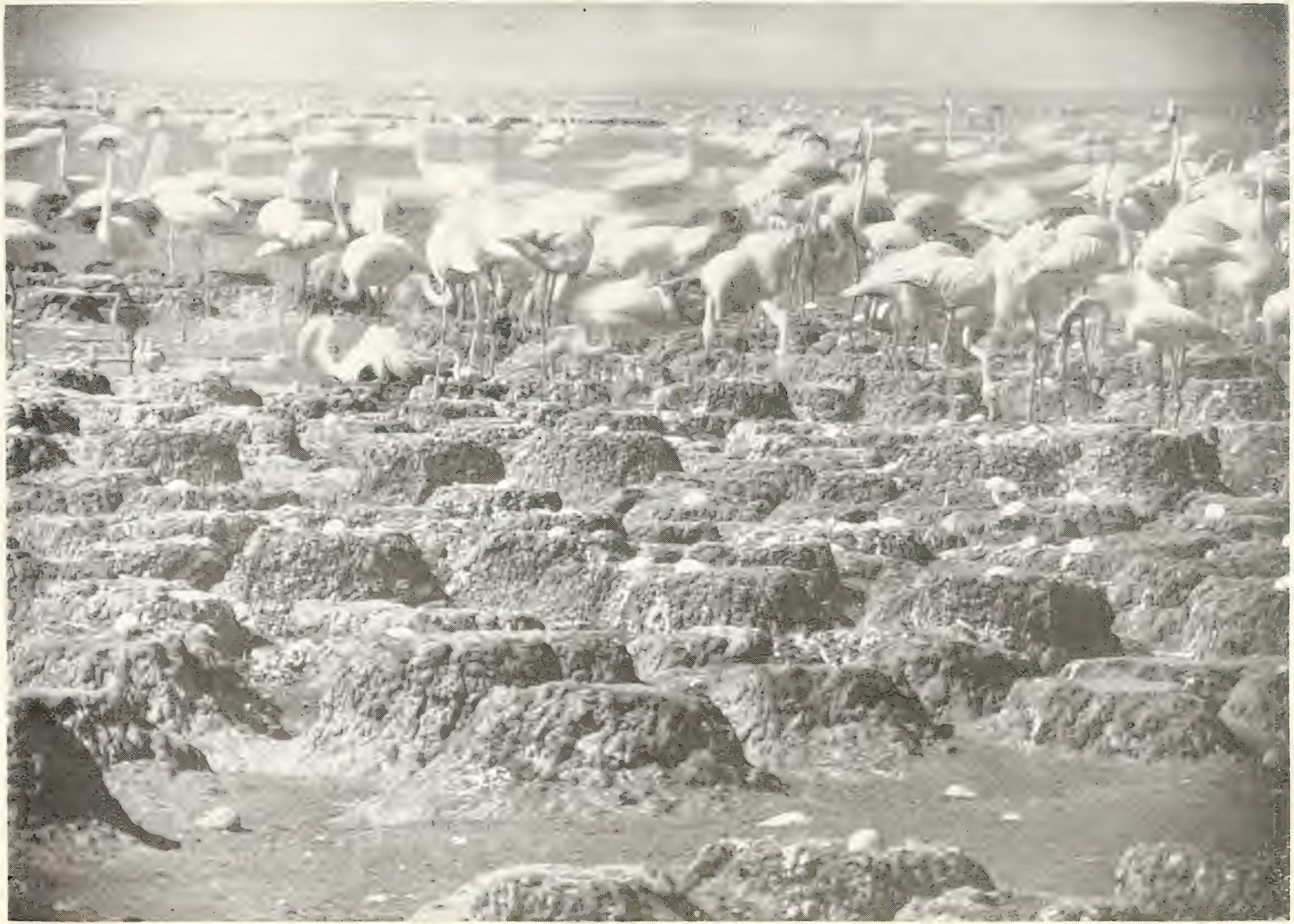


Photo by THE STATE PHOTOGRAPHER.

A close-up of a section of the Flamingo "City."

in. The chief photographer (the Captain) had to enshroud his head in several yards of black mourning cloth with his eyes glued on the focussing screen. From this position—the 'bridge'—he had to signal down orders to the 'engine room' as it were, to his assistant in front to turn the focussing knob this way or that, a little more to the right or just a wee bit to the left. The focussing knob was so far in front as to be quite out of reach of the Captain himself, and only a specially trained assistant could assist.

The camera, erected at the nest colony, showed up in the distance like a fair sized house on the bare flat expanse of the Rann. And when a wind sprang up and the black cloth round the Captain's head commenced to flutter and flap I thought there could be no earthly chance of getting any photographs of the birds. At first I was very loth to allow Ali Mohammad to go into action at all for I feared the disturbance might cost me the opportunity of making observations. I am afraid I was also inclined to be rather facetious at the Captain's expense but he bore it all with surprising good nature. It was not until we got back to Bhuj and he produced these (by me completely unexpected) results out of his dark room that I realised the laugh had really been on me. And further, when on return to Bombay I discovered the rather mediocre result of my own efforts with H. H.'s Kodak, it became more obvious than ever that it needs something more than a good camera to produce a good photograph.

OBITUARY NOTICE.

SIR NORMAN CRANSTOUN MACLEOD.

Sir Norman Macleod who was Chief Justice of the Bombay High Court from 1919 to 1926 died suddenly on the 5th July, 1945. Sir Norman was always interested in Natural History and was Honorary Treasurer of our Society from 1901 to 1906 and was Vice-President from 1918 to 1924. He was a keen sportsman and a good shot and went out regularly after snipe, quail and duck in the vicinity of Bombay.

Mr. M. R. Jardine—a very old friend of Sir Norman's at the High Court, Bombay, writes saying that Sir Norman continued to take great interest in the High Court both as regards its judgements and its administration right up to the end, and he frequently contributed articles to the Bombay Law Reports under a nom-de-plume.

It is only right that some notice should be recorded in our Journal of one who in his time did so much to help the Society.

W. S. M.

REVIEW.

A GUIDE TO BIRD WATCHING by Joseph J. Hickey. With illustrations by Francis Lee Jaques and Bird Tracks by Charles A. Urner. Pp. xiv+262. Published by Oxford University Press (1943) Price $ 3.50.

There are many things the youthful bird lover and the amateur ornithologist are constantly wanting to know about their hobby: How to observe, What to observe, What to record, How to record, What is already known, What has still to be learnt, and so on. Experienced workers are not always on tap, and not all average students can answer their difficulties. Thus it not infrequently happens that an enthusiastic and promising beginner, for want of suitable guidance, has his keenness blunted or diverted into other channels. Here, at long last, is just the book for just such persons, and no doubt the seasoned ornithologist will find it equally illuminating. Some of the chapter headings will indicate the wide scope of its contents: How to begin Bird Study, The Lure of Migration Watching, The Romance of Bird Banding, The Art of Bird Watching. They cover such topics as Distribution, Habitat Selection, Territory, Song, Food, Trapping, Censuses, Co-operative Bird Watching and others that are for ever falling within the purview of the intelligent watcher.

Methods of conducting investigations and the manner of recording and publishing them most usefully, are suggested. This *à propo* of that well-known type—a beginner usually—who is (quite pardonably) carried away by the imaginary importance and uniqueness of the observations he makes, and is convinced that they are all worthy of appearing in print forthwith. He is not a little disappointed, and even peeved, when harassed editors are obliged to differ. With the present and ever-rising spate in ornithological literature it is desirable that people who work or write on any particular aspect of birds should first acquaint themselves in a general way with what work has already been done on similar lines so as to avoid unnecessary redundance.

The Art of Bird Watching (Chapter 6) with its different sub-headings is particularly lucid and instructive, and will be read with profit by every shade and grade of bird lover. Chapter 3 entitled Adventures in Bird Counting is of special interest to us in India. It is a subject in which we have done no serious work so far, but which obviously holds enormous potentialities. When a proper scientific investigation of the economics of Indian birds comes to be undertaken, as it is bound to be under any well planned scheme of agricultural research, the importance of bird counts will be more fully appreciated. Take for example a species which has been determined by a study of its food and feeding habits to be harmful to agriculture, forestry or fishing interests in a given locality. How is the aggregate damage it causes to be assessed unless and until we possess sufficiently reliable data of the density of its population? It is a completely erroneous and misleading notion that *any* estimate of numbers is better than no estimate at all. Population counts to be of real use need to be fairly accurate. And in order to obtain accurate estimates certain techniques, evolved after much experimenting in other countries—notably England, America and Germany—have to be followed. The methods vary with local ecological conditions and the species of bird to be dealt with. Some of the methods now in use are described, which could well be modified and adapted to conditions obtaining here. But others will have to be evolved by ourselves to suit our peculiar needs. I have searched the pages in vain for anything to suggest a method of counting that could successfully be applied to some of the conditions we are up against here. For instance how can one obtain even the semblance of an accurate census of the thousands upon thousands of water birds of mixed species—Painted and Open-billed Storks, Herons, Cormorants (of 3 species), Darters, Egrets (of 2 or 3 species), Paddy Birds, White Ibises and Spoonbills—that nest in such bewildering confusion on some of our Indian jheels? In particular I have in mind the Keoladeo Ghana of Bharatpur which has defeated me more than once. I daresay some comparatively satisfactory method can, and will eventually, be devised. Our problem is to devise it. It is a challenge which some of the census experts in England might well take up, since obviously a greater degree of special experience in this line of work is called for than is available in our country. All these birds subsist more or less exclusively on fish. A single cormorant has been ascertained to eat about 14 lb. of fish per day. Painted Storks, by virtue of their larger size, presumably need a larger quantity. Young birds, moreover, are notorious for the healthiness of their appetite. And considering the multitudes of both adults and young that inhabit the Keoladeo heronry for several months in the year, it is evident that hundreds of tons of fish must be needed to sustain this vast population. Just what tonnage? That is what we are concerned to know. And if the species of fish that go to make these birds are of economic value to man, then so much the worse for Man!

The appendices at the end of the book are not its least interesting or useful part. Appendix A—An introduction to Bird Tracks—is a novel aspect of bird study which I believe is so far practically unexploited except in America. It is good to have attention drawn to it, though one may doubt the practical value of this study since by itself it can scarcely provide adequate clues or precise identification. Appendix C—Outline for Life History Study—is a helpful section and offers a number of suggestions of how an investigation may be carried out. The annotated list of books on various aspects of bird study forms a very desirable adjunct for those not in touch with the more important bibliography.

The usefulness of this well-written volume as a guide to bird watching is unquestionable. The general parts of it are of more or less universal application, but to us here in India much of the value of the book is lost since most of the examples cited are of American birds and American conditions with which the beginner and less serious student are not likely to be familiar. But the potentialities of this sort of epitome are patent, and it is to be hoped that some day one of our own ornithologists will undertake to 'Indianise' the more relevant portions for the benefit of bird lovers in this country, and of Indian ornithology in general. Till that day comes, I would strongly recommend this book to every one who has an interest in birds.

S. A.

MISCELLANEOUS NOTES.

1.—A TIGER'S RECORD AS A 'CATTLE KILLER'.

A tiger, which came to be known as the 'phantom' tiger, for until the day it was shot, it was neither seen nor located, was finally shot on the Billigirirangans (S. India) on July 11th, 1945—a male 9′ 5″ in length—in prime condition. This tiger invariably killed cattle or cart-bulls *inside their sheds or kraals* at night—never on their grazing grounds.

Its activities comprise:—

1. 2 buffaloes
2. 2 cows
   2 cart-bulls
   Separate sheds—same night
3. 2 buffaloes
4. 2 cows
5. 1 buffalo
6. 2 cows
7. 3 cows
8. 2 cows
9. 2 cows
10. 2 cows
11. 1 cow
12. 1 cart-bull
13. 1 cow
14. 3 cart-bulls
15. 3 cows
16. 4 cart-bulls
17. 1 cart-bull
18. 2 cows and 1 buffalo
19. 1 cart-bull
20. 4 cart-bulls.

Only in three cases did the tiger attempt to make a meal off its kills. Only in two cases did the tiger return to its kills the second night: the latter occasion ending its exploits.

Its head, neck, back and flanks were scored with scratches from forcing its way through the barbed wire fences.

Honnametti Estate,
Attikan P.O.
via Mysore, S. India.
10*th September* 1945.

RANDOLPH C. MORRIS.

2.—CALLING UP TIGERS.

I have read Corbett's 'Man-Eaters of Kumaon', a review of which appeared in the April 1945 issue of the *Journal* of the Society.

Commenting on Corbett's ability, by use of his vocal chords alone, to successfully summon tigers of both sexes to his vicinity, the reviewer remarks that in South India a mechanical contrivance is used to call up tigers.

This refers no doubt to the earthenware chatty, the mouth of which is tightly covered by a parchment-like skin, and the sound produced by pulling of a string, fastened to the inside of the parchment and passed through a hole in the base of the chatty. I have not myself seen this contrivance in use, but have personal experience of the vocal calling up of a tiger which will be of interest to the readers of the *Journal*.

While after sambar on the Brahmagiri Hills of Southern Coorg, my shikari (*a kurumba*) and I saw a tiger disappearing down a grassy slope, into a shola.

The shikari asked me to sit down near him below the crest of the hill. He cupped his hands together, placed them to his mouth. The sound was *Uh—h—h—ug*! *Uh—h—h—ug*! repeated two or three times. This struck me as so ridiculous, that I put my head down and shook with laughter—silent of course. An elbow jabbed my ribs—I raised my head—there, 75 yards away and twenty-five from the shola was the head of the tiger. He had come back to investigate the call. This investigation cost him his life.

Later on this same shikari took a planter out shooting. They heard a tiger in a shola. The shikari called, imitating a tiger's voice, but the animal did not walk straight towards the call. He came from behind the men and stopped a few yards from them. Something made them look round just as the tiger was perhaps about to attack them. This tiger also was killed.

I find there is in the *Journal* of the Society, Vol. xxxiii, page 696, an account of the decoying of a tiger by a tea planter. Two tigers had been frightening ponies in the stable near the house, and on the second night of his attempt to get a shot at the animals he heard them calling some three hundred yards away and started to imitate. In this way he got the male animal within a few yards of his verandah and killed it by aid of torch on his rifle.

Except for this record there does not appear to be any account in the Society's *Journals* of the calling up of a tiger by the human voice. There is an Editor's foot-note to the above that in Burma tigers have been known to be attracted to the concealed gunner by the peculiar bleating noise produced by blowing on a leaf held edgeways between the palms of the hands; a dodge commonly employed by the Burman pot-hunter for calling up Barking Deer and Sambar to be slain.

BANGALORE, W. F. RULE.
24th July 1945.

3.—THE SENSE OF SMELL IN TIGERS.

I only received the April number of the *Journal* a few days ago, or I would have written earlier to give my experience of the tiger's sense of smell, which does not accord with H.G.H.M.'s opinion. Elsewhere I have told the story of an incident which took place while I was a guest of that good sportsman, Dr. C. W. Quinn, civil-surgeon of Damoli, C.P. He sent me to sit over a kill by a tiger described by Fateh Khan—a highly experienced shikari—as 'a very wise and wily one, and one who would never return to a kill if there were any suspicious circumstances to warn him of lurking danger'. When Fateh Khan and I eventually found the kill, there were no trees in which a machan could be contrived, so Fateh Khan did what he could in an overgrown shrub. To cut a long story short, the tiger came about 4 p.m. and sat down underneath me, so that I could only see his tail by looking over my shoulder. After an appreciable time, he began to sniff, his inhalations growing louder and louder, and his back coming into view from the root of his tail upwards, as he gradually leant further and further back, until he eventually looked into my face—I can assure you his was unpleasantly close to mine, when he spat at me exactly as a domestic cat does, and dashed off under the low brush cover.

May I add as a postscript, what a joy the *Journal* is to me, and it goes from me to rejoice another retired from India.

CATCOTT,
N. BRIDGWATER, ARUNDEL BEGBIE,
SOMERSET, *Lt.-Colonel.*
11*th August* 1945.

[It is commonly maintained that a tiger hunts with his ears and eyes and makes little use of an enfeebled sense of smell. We know little as to the extent to which nocturnal animals rely on vision in getting their food. It is probable that all the tiger's senses play their purpose in its life—the predominance of any one of its faculties depends upon the individual and equally upon the factors in the environment which are then influencing its action.—EDS.]

4.—A LEOPARD 'POOKING'.

The following account of an experience of mine may be of interest.

Some time ago I sat up in fairly heavy virgin forest over a small bullock killed by a leopard. The kill was lying in a track cut through the undergrowth and was thus well exposed.

I got up into my shikar chair about 4.30 p.m. and in about half an hour spotted a big male leopard circling around in the undergrowth on my right. However he did not come out to the kill and gave no chance of a shot. He then moved out of my view.

Just at dusk I spotted him on the track about hundred yards away where he was more or less silhoutted against the afterglow in the sky, but too far away for a sure shot in the tricky light.

The animal seemed to moan or sniff about for a time, and then squatted down in the usual cat manner and defaecated, of course this act was not distinctly visible, but the signs were there when I examined the place later. Now comes the interesting part, after defaecation he moved forward a few paces in a stiff legged manner, and then let out a very high pitched cry, almost a squeak, best described as a 'pook' and at the same time stretched out and seemed to shake one of his hind legs, then a step forward, another call and a shake of the other leg. In all he made this call five times.

I have heard of tigers making this 'pook' call but never of a leopard, and I shall be very interested to hear if anyone has had a similar experience?

Finally I did not manage to shoot this beast, though he came on to the kill well after dark, as, on my switching on my torch he leapt into cover like a flash. I sat tight and after a short time, back he came and was off again on the switch of the light. A third time he came and on this occasion I allowed him to feed for about fifteen minutes (the kill was well pegged down) before taking up the rifle, first pressure taken on the trigger, but it was no use, he was off like lightning and for good this time.

I was once stationed for four years on a garden absolutely infested by leopards, where I saw and shot many of them, but never heard such a cry. The lightning reaction to the torchlight is also quite out with my previous experience.

Altogether a very interesting beast.

Powai T.E. & P.O.,
U. Assam. T. E. H. SMITH.
12*th August* 1945.

[The peculiar call of the tiger described popularly as 'pooking' is interpreted by some observers as a mate call. But it is indicated that the call has been frequently uttered as a direct result of disturbance by human agency and as such is probably an expression of surprise, suspicion or alarm. This call is not commonly observed among panthers.—Eds.]

5.—NORTHERN LIMITS OF THE RUSTY-SPOTTED CAT (*PRIONAILURUS R. RUBIGINOSUS* GEOFF.)

In the new *Fauna* the paragraph on the distribution of this cat reads 'Southern India' and there is reference to one specimen taken at Khandalla by Phillip Gosse.

It might be of interest to record that on the 2nd Feb. 1941 I shot one near Suriamal on the Wada road about 70 miles north of Bombay. This cat appeared to be fairly common in that area as we had seen them several times before when motoring through at night, but had mistaken them for stray domestic cats from nearby villages.

While I hope to obtain more specimens when travelling becomes easier, I might mention that another cat shot in the same area a few weeks later has been identified as a domestic cat, though a few spots on its flanks suggest that it may have a strain of this or some other wild cat in its origin.

MESSRS. FAIZ & CO.,
75, ABDULREHMAN ST.,
BOMBAY, 3.
12th July, 1945.

HUMAYUN ABDULALI.

6.—SAMBAR 'SWINGS'.

I wonder whether any members have seen—and, if so, can explain the purpose of—the Sambar's *jhoola* (swing). Whatever the purpose, I think it will explain a fairly well known superstition of the jungle people, concerning that deer.

In the month of January, but many years ago, I was shooting from a camp, which I was obliged (from the lack of fresh water) to pitch close to a small wayside station, Bahilpurwa, on the Jhansi-Manikpur line; with Manikpur the next station to the south and Karwi on the north. For a few miles northward from Bahilpurwa was a dense belt of thorn (Ber) Jungle, interspersed with trees and harbouring most of the game in that block—bear, sambar, chital, a few chinkara, in the thinner portions, and a few roving panther (though sambar were plentiful, tiger had not been there for about 10 years then—the dense thorn might explain this, for it held many small herds and solitary stags). On the east of the thorn belt and as far as the railway was tree jungle—some of which was being felled. Westwardly, the thorn gave to more open tree jungle—which contained a 'famine tank', close to the thorn belt. Roughly eastward of the tank, and near to where a straggly nullah seemed to separate the thorn from the tree jungle on the east, was a small glade where I saw one definite '*jhoola*' and two other, seemingly, attempted ones. A local villager had guided me to that glade to show me a 'soiling pool' in it; this was drying up then, but had not caked or crusted over and the mud, still boggy, showed signs of very recent use—the innumerable, short, curly hairs in it proving the user to be a sambar. The Indian then directed my attention to the broad trunk of a banyan tree at the edge of the glade and, when we arrived there, pointed at a thin branch overhead, saying repeatedly 'jhoola'.

What I saw was this: Upon the trunk of the banyan, facing the glade, were blobs and smears of moist, as well as dry, clay—the bark bearing reddish abrasions and scorings in many adjacent places—up to a height of about 5 feet. A couple of feet above this the trunk forked to right and left upwards, the large right arm (the one to my right) of the fork showing similar signs for a little way along it. This arm passed closely behind a seemingly dried up tree of another species, which grew about a yard away and had a curious twist to it all the way up and extending to its few branches. The lowest of these grew widely into a Y, the lower arm of which jutted out almost horizontally towards but diagonally away from me as I stood facing both trees. This narrow branch bore smears of clay too. The ground in front of both trees was pitted with the tracks of sambar.

Climbing to this thin branch (9 inches circumference, spanned by finger and thumb) and, closely examining it, I found that most of the clay was on its top and outer sides and that adhering to it were many of the short, curled hairs that grow below the 'burr' of a sambar's antlers; and in a few places I saw that the bark had been worn through to the wood, which showed the smooth polish of repeated friction.

Dropping to the ground I sought a means for measuring the height of that branch and my 12-bore, with its 30-inch barrels, best served the purpose; for, by holding it so that thumb and forefinger exactly encircled the line of the breech, and drawing down my shoulder to its limit, I was able to fairly scrape the branch with the muzzles—wearing then low-heeled crepe soled shoes. As my own height is exactly 72 inches, the height I thus reached to would be 120 inches, roughly—10 feet. Incidentally, the circumference of the trunk was, by spanning roughly, about 78 inches. That such a narrow branch had borne the weight of a full-grown stag—for some rakes in the soil below suggested that he must have swung—I could ascribe only to the spiral twist in the wood. What amazed and still puzzles me was that the signs indicated that, instead of merely rearing up against the large tree with his forefeet and then craning backwards to hook his antlers over the small branch, the stag had preferred to do so by reaching under and engaging it from the far side—and had succeeded!

At two other banyan trees, some distance away at the edge of the glade, the stag (or stags) had attempted to do the same thing. At one the attempt was quite tentative—merely hoof marks on the trunk. At the other—a tree, almost similar in shape to the first—the hoof marks went up to the fork (about 5 feet), then a little further along the arm to the right; here, at about 7 feet, it formed a narrow and steeply inclined Y—and the stag had tried to engage the lower arm from beneath and beyond! Had he succeeded, I am sure he'd have had the greatest difficulty in disengaging. Or, was he thus trying to shed his antlers? The signs on those trees were fairly fresh and the month was January. The several stags I saw there carried good heads of hard horn, but only one showed very bleached tips.

HOSPITAL SHIP 'MELCHIOR TREUB',
C/O BRITISH FLEET MAILS,
INDIA.
8th July 1945.

K. BOSWELL,
Capt., I.A.M.C.

[Commenting on the above Note Col. R. W. Burton writes:—Sambar stags are very fond of rubbing their horns against trees long after the horns are hard and all the velvet has disappeared. In many cases the beam, for some inches above the brow-antlers, is polished quite smooth from the habit. This would account for 'the bark worn through to the wood which showed the smooth polish of repeated friction' observed by your correspondent.

In most forest tracts of Central India and the Central Provinces the story, 'myth' it can be styled, that sambar have the habit of swinging by their horns is widely believed and related by the jungle tribes, Bhils, Gonds, Konds, Korkus. I have often had a tree pointed out to me as being one used by Sambar for the 'Jhoola' practice (Hindustani, *Jhoolna,* to swing).

Dunbar Brander, at page 178 of this book 'Wild Animals in Central India' describes what he terms 'preaching' by Sambar stags and has 'seen the stag's antlers become entangled in the overhanging bough, and this no doubt has given rise to the story that they swing by their horns'.

I never met a jungle man who could say that *he* had witnessed the swinging. It is no doubt a myth, like some other jungle beliefs, with some sub-stratum of truth as foundation for the story.—EDS.]

7.—THE DISTRIBUTION OF THE THAMIN (*PANOLIA ELDI*).

In his article on the 'Larger Deer of British India' in the *Journal* of the Society, Vol. xliii No. 4 of April 1943, R. I. Peacock gives the distribution of *Panolia eldi* as 'Manipur, Burma as far South as Tennasserim probably at least the Northern parts of the Malay Peninsula, Siam, Annam, and Hainan'.

Although Burma naturally includes Arakan there is no mention of any specimens ever having been obtained from that District or from that part of Eastern Bengal with which it marches.

I was surprised to come across Thamin during the recent campaign in Arakan on two or three occasions. My attention was first drawn to the presence of this species by Lt.-Col. Edgerly of the Civil Affairs Service, and late of the Burma Forest Service, a keen naturalist who knows the Thamin well, and thought it strange to find it on the west coast.

I never managed to shoot one, and personally saw only two, both adult males, and in the winter only.

One of the locals had caught a young female and had it as a pet in his village.

They seem scarce and very local and confined to the low ground and coastal foothills on either side of the Indo-Burma border where the country in winter is dry, and the jungle scrubby and open, with grassy hillocks, 'kunai' grass growing on the foothills.

The southern limit in Arakan seems to be MAUNGHNAMA about 10 miles North of MAUNGDAW.

How far North does it extend?

It certainly occurs in the open foothills 15 miles N-E of Cox's Bazaar where I have seen it twice. I found some Chittagonian villagers and local shikari knew it, but all said it was scarce. The Kumis and Moros who lived higher up had never heard of it.

Villagers said they never saw them in the monsoon, but the monsoon is so heavy that villagers do not get about much at that time. Is it possible that the Thamin migrates over the Yomas from the east in the dry season? On the other hand the doe in captivity in the village of Maunghnama was taken as a fawn in October 1943.

I hope someone will secure a specimen in order to ascertain whether there is any deviation from the type.

MAIN HEADQUARTERS,
15 INDIAN CORPS,
11 A.B.P.O.
20th June, 1945.

A. F. PHILIP CHRISTISON,
Lt.-General.

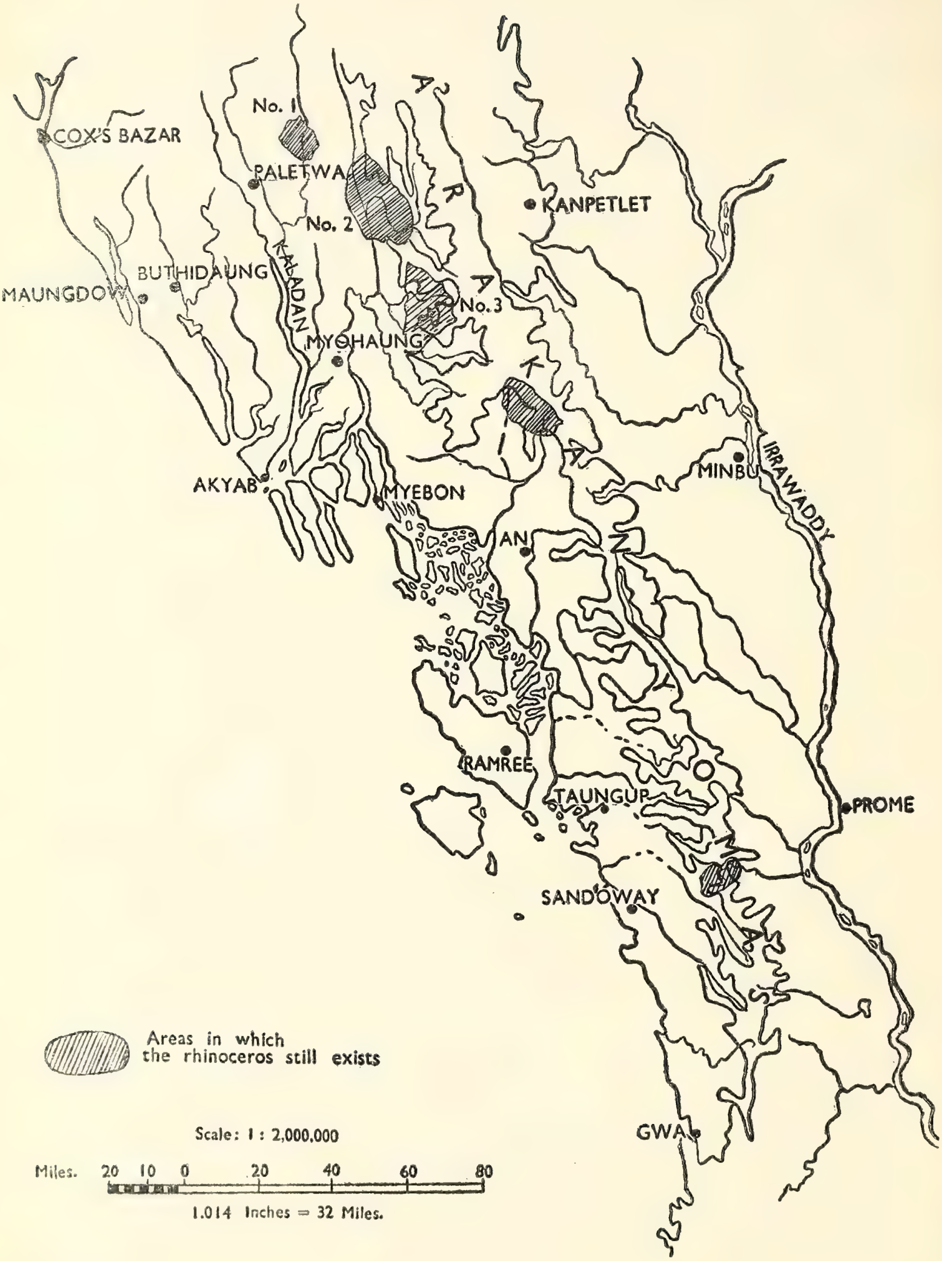
8.—A NOTE ON THE PRESENT DISTRIBUTION OF THE SUMATRAN RHINOCEROS (*DICERORHINUS SUMATRENSIS*) IN THE ARAKAN DISTRICT OF BURMA.

(*With a map*).

The recent campaign in Arakan from the autumn of 1943 till May 1945 offered a unique opportunity for trying to ascertain the present distribution of the Sumatran Rhinoceros in this District. Throughout this period I had special patrols, usually consisting of two British officers with some local levies and interpreters, operating in the Arakan Yomas east of the Kaladan and Lemro rivers, and later all the way south to the Sandoway Yomas. I briefed these officers, and they sent me regular reports of their observations. Unfortunately none of them were naturalists, but they produced much useful material, and this note is a collation of their reports.

Visual records were very few indeed. During the whole period only three were seen by British officers. In addition, tracks were seen at rare intervals, and droppings and wallows were pointed out by locals. On only two occasions were tracks pointed out as belonging to a cow followed by a calf. However, local tribal headmen who were consulted by patrol leaders knew the animal well where it existed, while others were quite definite either that it had never been known in their area, or that none had heard of it in their lifetime, though it used to be known there.

As these patrols moved continuously in the Yomas, and as I was constantly asking them about rhinoceros, I got a pretty


COX'S BAZAR
No. 1
PALETWA
No. 2
KANPETLET
BUTHIDAUNG
MAUNGDOW
KALADAN
No. 3
MYOHAUNG
ARAKAN YOMAS
AKYAB
MYEBON
AN
MINBU
IRRAWADDY
RAMREE
TAUNGUP
PROME
SANDOWAY
GWA
Areas in which the rhinoceros still exists
Scale: 1 : 2,000,000
Miles. 20 10 0 20 40 60 80
1.014 Inches = 32 Miles.

P. Christison.

Present distribution of the Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) in the Arakan District of Burma.

comprehensive picture of its present distribution, but a very vague one as regards numbers.

The accompanying sketch shows the areas where this species undoubtedly still exists.

As regards the three actually seen :—

No. 1 was seen in January 1944 about 70 yards away in a sandy wallow in a rocky gorge. On getting wind of the party it dashed into thick cover, and from the noise apparently made straight up the hill side.

No. 2 was seen in the early morning in April 1944, standing near a stream 100 yards away. When the officer crawled up nearer to observe it he heard it make off, and never got a second sight of it.

No. 3 was surprised on a game path on the spine of a bamboo covered ridge. It wheeled round and made straight back up the path. This was in March 1945.

All these were seen by different officers, and all the officers were quite definite that the animal only had one horn. I do not accept this as indicating *sondaicus*, as this species is probably extinct in Arakan and does not haunt the hill crests like *sumatrensis*. The posterior horn is not likely to have been noticed by untrained observers.

Main Headquarters
15 Indian Corps,
11 A.B.P.O.
24th July 1945.

PHILIP CHRISTISON,
Lieut.-General.

9.—THE TAMIL NAME OF THE INDIAN PANGOLIN (*MANIS CRASSICAUDATA*).

On page 233, vol. 45, Miscellaneous Notes—6 of the *Journal* of the Society, Mr. R. W. Stoney refers to the Tamil name of *Manis crassicaudata* as *'Arrunkku'*. The name by which the animal is very commonly known in the Tamil Districts of Trichinopoly, Tanjore and Madura, is *'Alungu'*. In other places it is called *Kalundu 'Kadhundu'*.

Udumbu, as he rightly says, is the Tamil name for the Monitor Lizard—*Varanus* sp.

State Museum,
Pudukkottai (s. india).
3rd July 1945.

K. R. SRINIVASAN, M.A.,
Curator.

10.—NOTE ON THE INDIAN PANGOLIN (*MANIS CRASSICAUDATA*).

(*With a plate*).

I obtained a male Pangolin on 6-7-45. It had been seen two or three days previously floating in the floodstream of the Mutha River at Poona. It rapidly became very tame; it appeared also to become accustomed to being taken out in daylight. My observations of its behaviour conform with the account given in Sterndale's 'Mammalia of India'. In addition however observations were made on its mode of digging. When put in an opened termite nest it would set to work unembarrassed by spectators.

First it would sniff around, moving its snout rapidly from place to place and making an occasional tentative scratch with a forelimb. When it had selected a spot it would begin to dig making a few scratches with each forefoot alternatively. The rapid sniffing continued all the time, as the hole began to appear. As it progressed it would sometimes change direction, the animal appearing to be guided by smell. If it started working sideways or upwards it would turn over onto its side or back as the case might be, and continue to dig in these positions.

Photograph No. 1. shows it working on its side. The hind legs were then frequently applied to the walls or roof of the hole to obtain a better purchase. When the hole was well advanced it would periodically back out to eject the excavated earth. The actual ejection from the mouth of the hole was performed in two movements. First the hind legs were planted firmly astride and by a rapid movement of the whole of the forepart of the body (as when curling up) the earth was shot between the hindlimbs. This is shown in photograph No. 2. the part of the body in rapid motion at the moment of exposure (1/50 sec.) can be seen to be blurred. The downward curve of the tail was caused by the fact that tip caught the ground as it moved backwards. Secondly the forelimbs are planted on the ground and a vigorous backward thrust is made with the hindlimbs together. The animal then returns down the hole until the next load is ready to be shifted.

When it struck one of the combs[1] in the nest, the digging would cease whilst the ants are eaten. There were however many ants still in the remains of the comb when ejected.

For about six weeks it was fed on white ant combs and condensed milk. In its box it would start on the combs as soon as it smelt them, and sniffing continually, turn over the bits of comb with rapid strokes of its tongue. The worrying action of the tongue crumbled up the comb. I was puzzled by the fact that it did not appear to pick up any of the actual comb, on its sticky tongue. It would sometimes lick my hands if I had been handling combs, the tongue did not feel sticky.

On this white ant diet, its faeces were a bright straw yellow, and the consistency of half set jelly, they were squirted out in one action, they always appeared to contain some membrane.

With a view to accustoming it to a change of diet in preparation for a journey, the white ants were stopped, and it was fed on milk alone for ten days, and then on milk and custard.

Four days after this it died (31-8-45). The cause of death was not known; there was a fair amount of fat in the tissues

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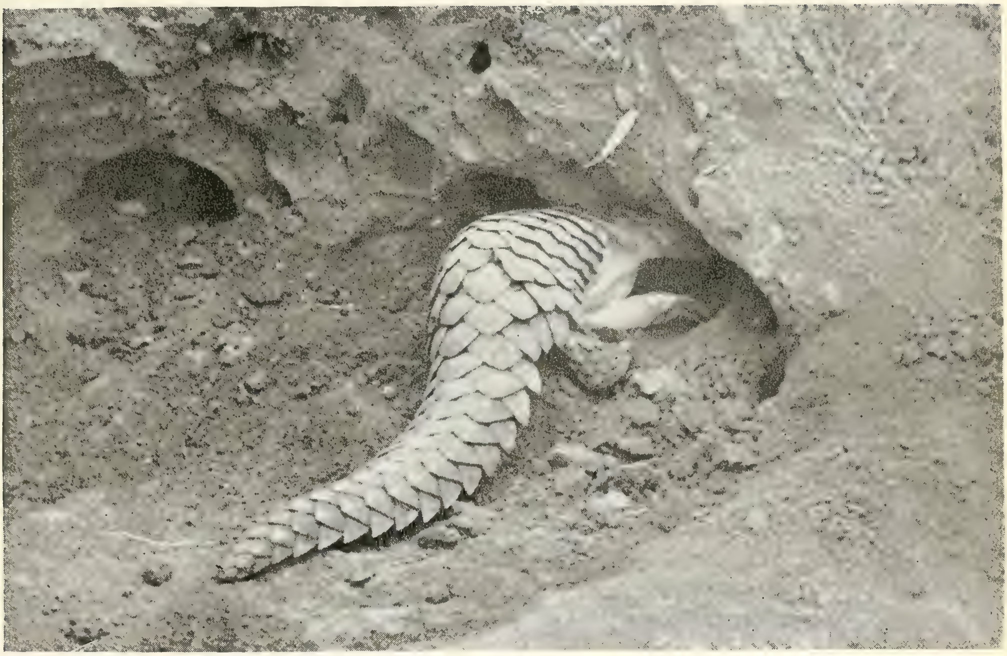
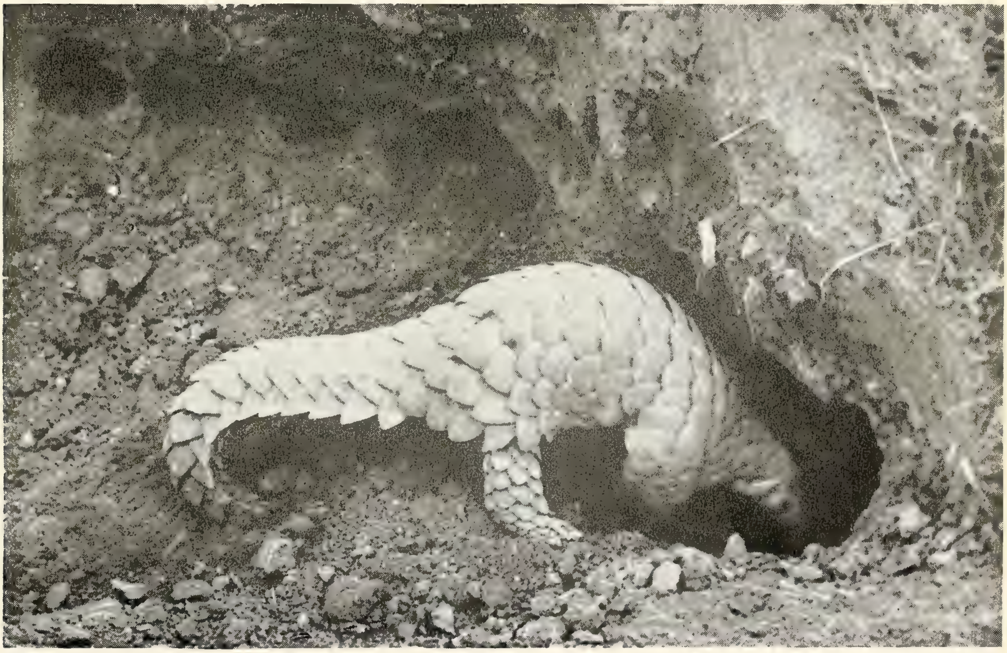
[1] Fungus gardens.—EDS.



1. The Indian Pangolin.



Photos by G. UNDERWOOD.

2. The Indian Pangolin.

so evidently it had sufficient food; the stomach was nearly empty, so evidently also it was able to digest its food.

I send a tube of ticks preserved in spirit, some of them were found round the anus, but the great majority were found under the scales which provided ideal shelter. I noticed that the ticks were quite willing to bite me. I hope you can identify them.

No. 1. Light Scout Car Field Park,
A. B. P. O. W. GARTH UNDERWOOD.
9th September 1945.

11.—WHISTLING THRUSH (*MYOPHONUS CAERULEUS*) PREYING ON OTHER BIRDS.

The other day while watching a pair of Whistling Thrushes (*Myophonus caeruleus*) in Naini Tal and trying to locate their nest, I noticed one of them fly down on to the ground when it was immediately attacked by several angry small birds, chiefly the dark grey Bush Chat. The Thrush appeared from the long grass with something large in its beak which at first I took to be a large slug, but soon saw it was a young bird, fully fledged. The Thrush flew off on to a boulder and beat the small bird to kill it and then flew away with it in the direction of its nest. I never found this nest because it was built on the side of a particularly poisonous drain and I could not bear the smell long enough to stay and watch.

Could you tell me if it is usual for this Thrush to kill young birds; it seemed to me not very characteristic of it; it could not possibly have fed its own young with the bird it had killed.

1/29 Prithviraj Road,
New Delhi. Mrs. A. B. M. WAY.
24th June 1945.

[While Whistling Thrushes (*Myophonus*) are carnivorous in the sense that they eat worms, insects etc. they are not usually given to feeding on other birds: an individual may however acquire such a habit as a development of its carnivorous appetite. A Whistling Thrush in captivity was seen to kill and feed on a mouse which entered its cage. Eds.]

12.—BLACK-CAPPED KING FISHER [*HALCYON PILEATA* (BODD)] NESTING IN INDIA.

My brother, Shamoon, was touring Mysore this year, when (5th May) he found a nest of this Kingfisher in the banks of the Sheravati River at the ferry just above the Gersoppa (Jog) Falls. The nest was about 3′ deep and contained 2 newly hatched young and two eggs.

This is a Chinese species, and though it straggles up the coast of Western India, as far north as Bombay during winter, the only nesting record from India is Stewart's (Nidification iii, p. 423), who took four eggs from a hole in the bank of a small river in Travancore forest. Nests have been taken in Burma and at Bangkok, but though fairly common in the Malay Peninsula, the next nesting records are from Hongkong and Foochow.

MESSRS. FAIZ & CO.,
75, ABDULREHMAN STREET, HUMAYUN ABDULALI.
BOMBAY.
19th June 1945.

13.—NOTES ON THE BEHAVIOUR OF NESTING PADDY BIRDS (*ARDEOLA GRAYII*) IN KASHMIR.

(*With two plates*).

The Paddy Bird, Pond Heron or Blind Heron has had the good fortune of being rescued by 'Eha' from a somewhat drab obscurity with a sparkling phrase.[1] The bird is not uncommon in Kashmir where it breeds in the Vale in some numbers, nesting by or above water usually in willow trees. The main facts relating to its nidification are already well-known and need not be recapitulated here, although some notes elicited by a spell of watching the breeding bird in Kashmir this summer (1945) may be of interest.

During the breeding season, the Paddy Bird is by no means the 'silent bird' of Mr. Stuart Baker's *Fauna of British India;* instead, in the vicinity of its nesting site, it keeps up an incessant talking. A favourite call is a contented 'huh' varied with a sort of asking sound, a duo-syllabic 'yuck-kuck' like old men exclaiming in weak voices. In its breeding plumage, the Paddy Bird is extremely handsome, the head, in both sexes, developing a long pointed white crest; while the back is adorned with decomposed feathers of a rich maroon colour. Both crest and back feathers are used in display as will be described hereafter. The young, especially when clamorous for food, are also noisy keeping up a continual 'chick-chick-chick', a noise uttered by the young of other members of the heron tribe. A great part of the time is spent by the adults and the more grown-up young in a careful preening of the feathers principally of breast and wing. Both young and old, like the Darter, habitually vibrate the throat, the action having the effect of a pair of bellows which blow the small feathers adhering to the mandibles from constant preening, gently and flutteringly in an outward direction.

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[1] In his *Common Birds of Bombay,* Eha writes of the Paddy Bird, it 'is little persecuted and grows very familiar, allowing you to approach within a few paces before it suddenly produces a pair of snowy wings from its pockets and flaps away'—EDS.

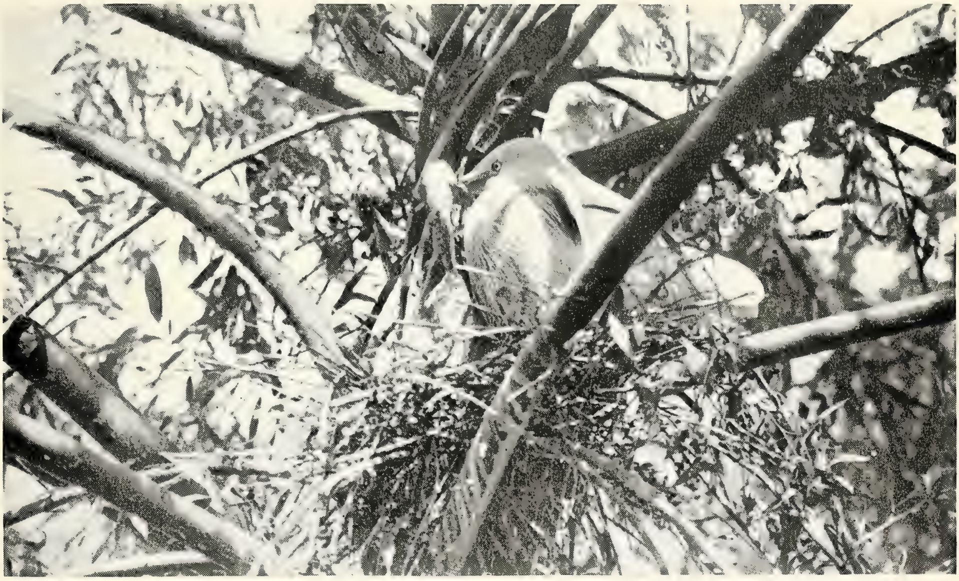
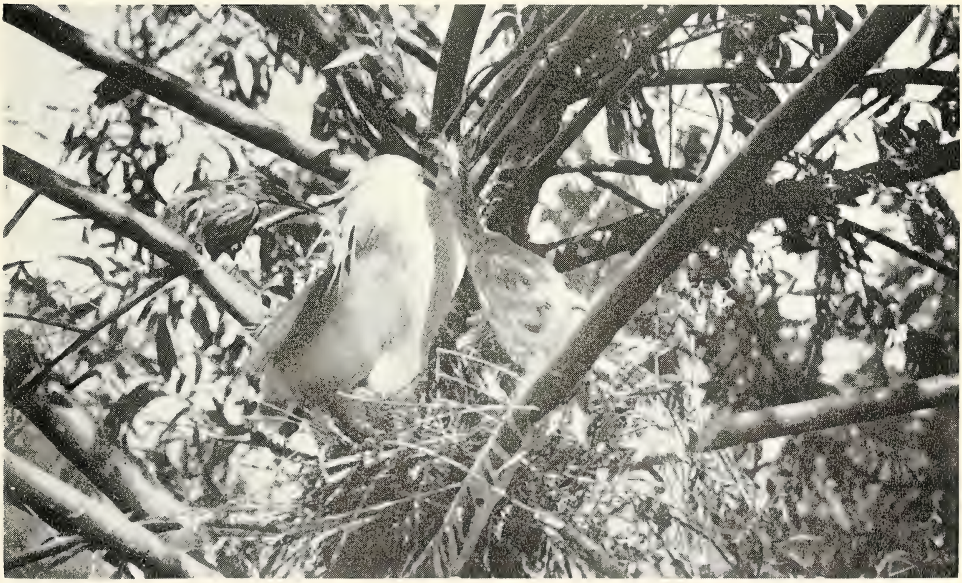


Fig. 1. "*Asking for more.*"



Photos by W. T. Loke.

Fig. 2. "*— and yet more.*"

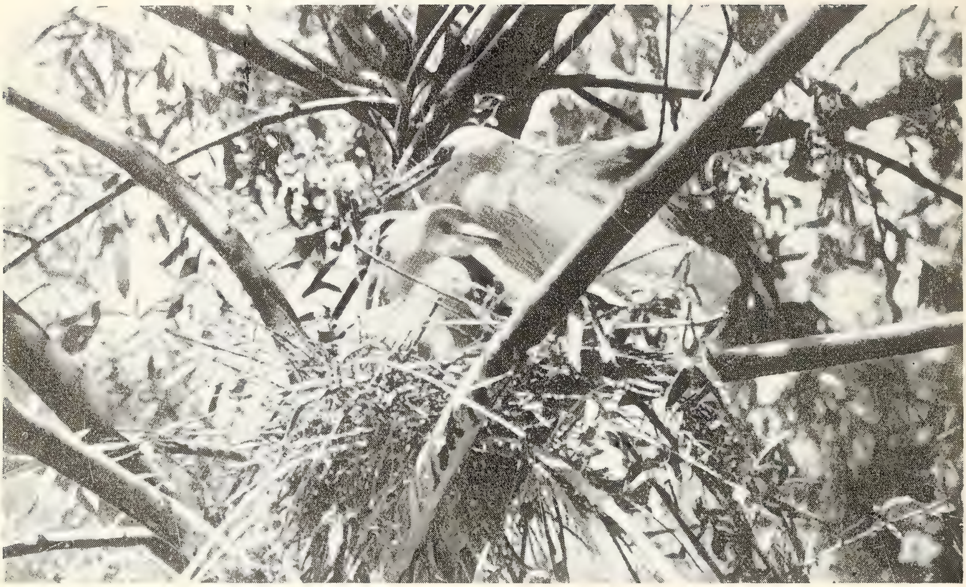
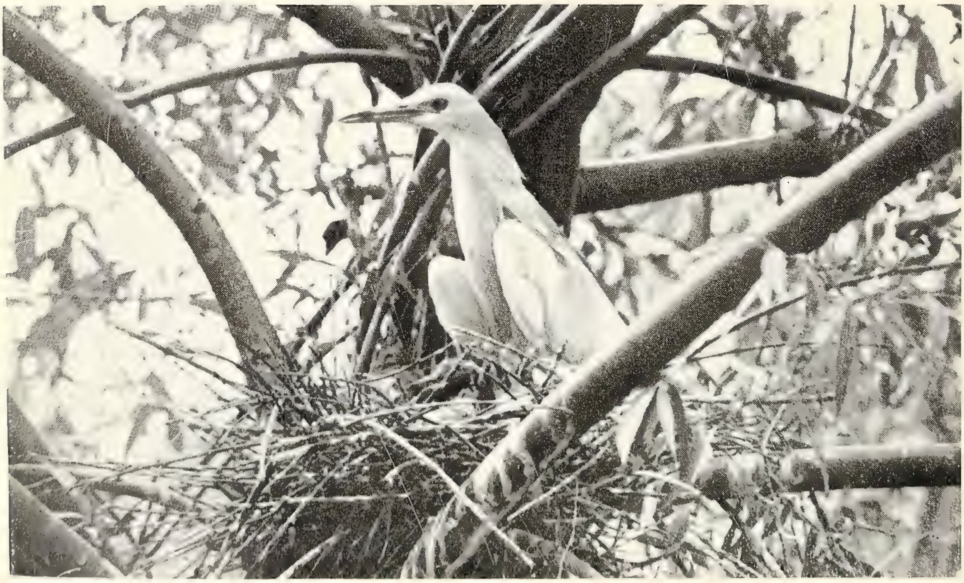


Fig. 1. Greeting display by Paddy Birds.



Photos by W. T. LOKE.

Fig. 2. Paddy Bird sheltering chick from sun.

Due to the presence of crows (*Corvus s. zugmayeri*) near the nest I was observing one parent, even when the chicks were almost ready to fly, remained always on guard. Errant crows or returning parents were greeted in a similar fashion; the crest feathers were raised and spread, the breast and back feathers fluffed out and shivered. (See fig. 1, Plate II). In addition, in the greeting ceremony, the birds welcome each other with cries, the parent on guard rushing up to the returning bird as though to drive it off. When they get near, defiance gives place to the endearments and the birds will caress and nibble the feathers of one another's neck.

The young birds, when they are large enough, demand food from their parents in a most curious fashion. In this connexion I should like to refer the reader to Lt.-Col. R. S. P. Bates' article in the *Journal* (Vol. 44, pp. 179 seq.) describing a similar display in the case of the Little Bitterns (*Ixobrychus minutus*). The bill of an adult is seized by a youngster in its own mandibles and vigorously twisted, the head of the former being sometimes forced to the level of the floor of the nest. (See figs. 1 and 2, Plate I). That the adult does not enjoy this kind of treatment is proved by the attempts (not always successful!) to escape filial attention by stretching the telescopic neck to maximum extension. When the young become too importunate, the adult will leave the nest and seek quiet on a distant branch of the family nest-tree. When the bill of the parent is out of reach, the young practise their 'asking-for-more wrench' on the twigs or branches. They will also bill-wrestle with each other. The young are fed by regurgitation, the parent depositing food on the floor of the nest and this is seized with avidity by the hungry youngsters. On one occasion I also saw a young bird, an hour after it had been fed, bringing up two pieces of fish which were then picked up and eaten by one of its three brethren. The bill does not appear to be much used by the young as an aid in climbing, although when caught for ringing they invariably seized their feet in their own mandibles.

Fig. 2, Plate II shows a parent sheltering a chick under its wing from the heat of the sun.

BOMBAY. W. T. LOKE.

22nd September 1945.

14.—ON THE OCCURRENCE OF THE CLUCKING TEAL (*NETTION FORMOSUM*) IN THE MONGHYR DISTRICT.

Stuart Baker notes in his 'Game-Birds of India, Burma and Ceylon' that the occurrence of the Clucking Teal (*Nettion formo-*

sum) within Indian limits is of the rarest. It may therefore be of some value to add to the known record of its occurrence in India. A male of this species in full breeding plumage was shot at Simri Bakhtiarpur in the north of the Monghyr District in the winter of 1937-38 by Mr. Krishnanand Sinha, Proprietor, Banaili Raj. The stuffed skin is now in the Patna Museum.

CHHAJJUBAGH,
PATNA. D. E. REUBEN.
30*th June* 1945.

15.—RECORD CLUTCH OF EGGS OF THE WHISTLING TEAL [*DENDOCYGNA JAVANICA* (HORSF.)]

While climbing up into a Banyan (*Ficus bengalensis*) tree to get a shot at a mugger in a village tank (Sandhana, Kaira Dist.) on September 1st 1945, I found a Common Whistling Teal (*Dendocygna javanica*) including a clutch of seventeen (17) eggs. Though the Whistling Teal is common in Kaira District this happens to be the only nest I have found of this species; so I cannot say what the usual number of eggs in a clutch is in this district. However on looking up the matter I find the following information:—

Stuart Baker—6-8 eggs. In Punjab and Western India 10-12 common. Assam 4-5.
Whistler—8-10 ' . . . though more or less are often laid'.
F. Finn—'About a dozen white eggs are laid . . .'.
Salim Ali—'Seven to twelve eggs form the normal clutch, the commonest number being 10'.

I am fairly certain that only one bird laid these eggs, as when I fired at the mugger, the duck off the nest, joined by its mate, were the only two Whistling Teal to be seen flying around the smallish tank.

METHODIST HOSPITAL, H. C. ALDRICH,
NADIAD, GUJARAT. *Surgeon-in-charge.*
9*th September* 1945.

[Stuart Baker (Nidification of the Birds of the Indian Empire, Vol. iv, p. 501) says that the normal clutch is eight to ten which agrees with the estimates of many observers but occasionally exceptionally large clutches are laid. He had one record of sixteen and two clutches of twelve and fourteen, both of which *appear* to have been laid straight on end by one and the same bird.—EDS.]

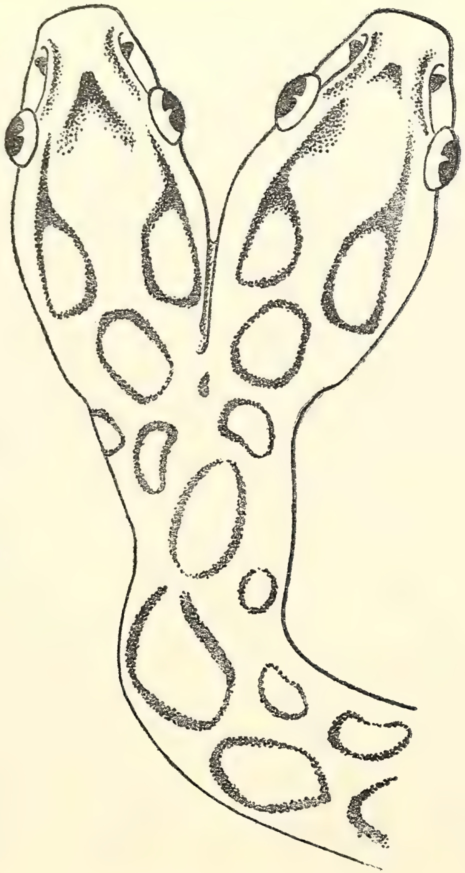


Fig. I. Dorsal view of the head of abnormal *Vipera russelli.* × 3.

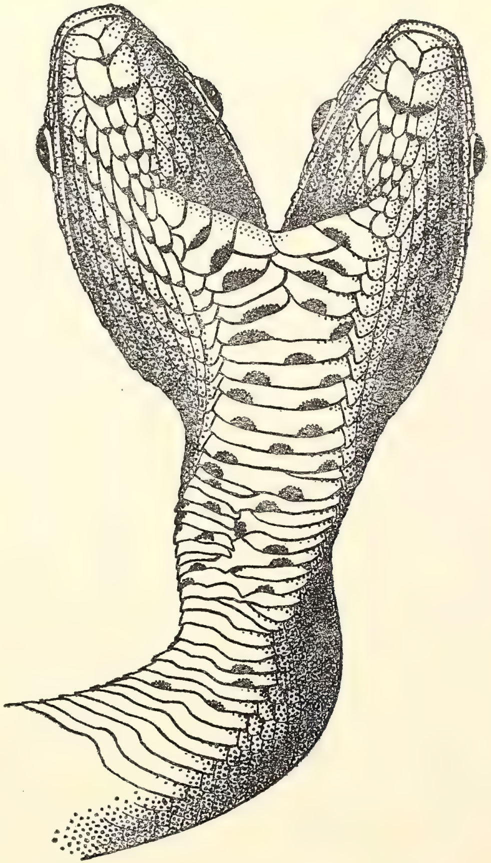


Fig. II. Ventral view of the head of abnormal *Vipera russelli.* × 3.

16.—AXIAL-BIFURCATION IN [*VIPERA RUSSELLII* (SHAW)] FROM BENGAL.[1]

(*With a plate*)

Though there are many authentic records of the occurrence of double-headed snakes from different parts of the world, only three such specimens appear to have been recorded in India so far. Dobson[2] reported, in the form of an abstract, cases of anterior dichotomy in two specimens of *Lycodon aulicus* (Linn.) and *Naja tripudians* Merr., belonging to the Indian Museum. The third record is by Wall[3], who gave an excellent account of the abnormality in the cephalic region of a juvenile specimen of *Lycodon aulicus* (Linn.), found in the Fyzabad Museum. He remarked: 'It is perhaps not so well-known that the genuine double-headed snakes do occur occasionally as freaks, but in these instances both heads are always attached to the anterior extremity of the body constituting what is technically called anterior dichotomy'.

Among various kinds of abnormalities, Johnson[4] recorded over a dozen instances of dicephalic condition found in snakes, picked up from the various museums of America, and tried to explain this abnormal condition with the help of skiagrams.

Recently Cunningham[5] has reviewed the published literature on anterior dichotomy or axial-bifurcation in snakes and has given the geographical distribution of the abnormal specimens as follows: North America 76, Central America 4, South America 5, Europe 31, Asia 10,[6] Australia 2, Africa 3 (Total 131).

The specimen of *Vipera russellii* that forms the subject of the present note is in the collection of the Zoological Survey of India. It was caught at Tarakeswar in the district of Hooghly, Bengal, and was purchased in May, 1929. It has been kept in alcohol over a period of 16 years, and has turned hard and unfit for any anatomical investigation. It is 216 mm. in length and is no doubt juvenile. The maximum length of the species so far recorded is about 5 ft. 6 inches. (Brook-Fox).[7] On account of the present condition of the specimen and lack of facilities for X-ray work, it has been possible to make observations on external characters only.

In order to study the changes in the general form due to dicephalic condition, the abnormal Russell's Viper (Fig. 1) has been compared with a normal specimen of the same species and of almost the same length. In the abnormal specimen the heads have undergone no change in shape etc., but the scales appear to be slightly fewer in number than in the normal specimen, as is seen in the following table:—

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[1] Published with the permission of the Director, Zoological Survey of India.

[2] Dobson, G. E., *Proc. Asiat. Soc. Bengal,* pp. 23-24 (1873).

[3] Wall, F., *Journ. Bom. Nat. Hist. Soc.,* XVI, pp. 386-388 & 752-753 (1905).

[4] Johnson, R. H., *Trans. Wisconsin Acad.,* XIII, pp. 523-535 (1901).

[5] Cunningham, B., *Axial-Bifurcation in Serpents,* p. 68 (1937).

[6] Probably the three abnormal specimens recorded from India have been included under 'Asia'.

[7] Brook-Fox, F. G., *Journ. Bom. Nat. Hist. Soc.,* VIII, p. 565 (1894).

TABLE I.

Scale of abnormal and normal specimen of Russell's Viper.

—	Scale counts			Total length
	Ventrals	Mid-body	Subcaudals	
Abnormal Specimen (Reg. No. 20434)	165	29	48	216 mm.
Normal Specimen (Reg. No. 3144)	168	31	52	220 mm.

The slight variation in scale count is within the range of variation as shown by Smith;[1] Ventrals ♂ and ♀ 153–180; Subcaudals ♂ and ♀ 41–64; Scales in the Mid-body 25–29; 27–33; 21–22.

No appreciable difference could be detected either in lepidosis or in the shape and size (Table II) of the heads. Dentition is normal and the poison fangs are developed in both the heads. The two mouths appear to be capable of functioning in a normal way.

TABLE II.

Measurements (mm.) and scalation of the right and left head of the abnormal and normal specimens.

—	Abnormal head		Normal head
	Right	Left	
Length of head	17	16	16
Breadth of head	9	8	8
Scales between nasal and eye	2	2	2
Scales round the eye	12	14	14
Number of supralabials	10	10	10

The ventral scales up to the 8th are normal, but from the 9th to the 17th they are irregular (Fig. 2) and broken in the middle. There is a slight vertebral projection, but without a skiagram it is not possible to locate definitely the exact point at which the projection has taken place. The projection lies at a distance of 34 mm. from the tip of the snouts.

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[1] Smith, M. A., *Fauna Brit. India* (*Rept. & Amph.*), III, p. 483 (1943).

Johnson (*loc. cit.*, p. 533), has attached great importance to the 'Degree of bifurcation'. In almost all cases the angle of bifurcation has been ascertained either by dissecting the specimens or with the help of skiagrams. With the specimen under report either of these methods could not be resorted to.

Very little information is available on the behaviour of double-headed snakes. Some authors, as Wall, Fischer[1] etc., observed the behaviour of abnormal specimens kept in captivity.

Heasman[2] who carried out anatomical investigations on a double-headed *Coluber* (*Zamenis*) *florulentus* Schlegel, has stated that as 'each head has a complete set of receptor organs, a complete brain and a normal musculature it is reasonable to suppose that the heads, being subjected to different stimuli, will behave independently'.

A very interesting account of the behaviour of a double-headed American hog-nosed snake (*Heterodon simus*), was published in the *Madras Times* in 1897. It was stated that the snake used to feed with the two heads simultaneously, and the heads sometimes fought, and at other times played with one another.

I am grateful to Dr. B. N. Chopra, Director, Zoological Survey of India, for going through the manuscript and for making some suggestions. I wish also to thank Mr. A. K. Mondul, artist, Zoological Survey of India, for the drawings he has made for this note.

ZOOLOGICAL SURVEY OF INDIA,
BENARES CANTT., M. N. ACHARJI, M.SC.
3rd August 1945.

17.—ADDENDA AND CORRIGENDA TO 'THE BUTTERFLIES OF THE NILGIRIS' PUBLISHED IN VOLS. XLIV AND XLV OF THE JOURNAL.

ADDITIONS.

New Species :—

292. *Pathysa antiphates naira*: Recorded from the Nilgiris in July or August (Sanders).

293. *Appias paulina wardi*: Foot of the Nadgani Ghat in January (Emmet). Several from below Coonoor. (Florence).

294. *Prinoris sita*: Two from the middle of the Nadgani Ghat in July or August. (Sanders).

295. *Colotis amata modesta*: ♀v. *albina*: Recorded from the Nilgiris by Sanders.

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[1] Fischer, E. C., *Scientific American*, LXXV (1896).

[2] Heasman, W. J., *Journ. Anatomy* (Cambridge), LXVII, pp. 331, 345 (1933).

Rearrangement of local *Melanitis*:—

91. *Melanitis leda ismene.*
92. *Melanitis phedima varaha.*
93. *Melanitis zitenius* subsp. nov.
94. *Melanitis tristis* (or *M. phedima* v. *tristis?*)
296. *Melanitis* sp. nov? (or *M. leda* variety?)

In the list the female described was wrongly attributed to sp. *phedima*. It is obvious from further specimens of both sexes caught in August at Walayar, near Coimbatore, that it is *zitenius*, and apparently a very distinct subspecies. (See the description given in the list, the male being very similar but differing in shape. See also illustration in vol. xliv).

On the Mettupalaiyam Ghat in the wet season at the end of the year there is a very common *Melanitis* similar to *M. leda D.S.F.* but larger, brighter above, and more deeply and distinctly marked below. This flies together with *M. leda* W.S.F. In the list this species was attributed, perhaps nonsensically, but by a process of elimination, to *M. zitenius*. In the dry season only the D.S.F. of *leda* apparently is to be found. What is this species . . . a variety of *leda* or *a* distinct species?

A detailed study of the imagines and larvae of the local *Melanitis* would probably repay anyone who had the time for it.

297. *Nacaduba pactolus continentalis*: Recorded from Wenlock Bridge, Kallar and the Nadgani Ghat in July and August. (Sanders).

298. *Thaduka multicaudata kanara*: Foot of the W. slopes in May and January. Silent Valley in the same months. (Pringle).

299. *Pratapa deva deva*: Below Coonoor and at Kallar in July and August. (Sanders).

300. *Tajuria jehana*: Mr. Wenlock Bridge in July or August on Loranthus (Sanders). Tiger Hill, May. (Rawlins).

301. *Tagiades distans*: Major Emmet pointed out to me that *T. distans* apparently is found in the Nilgiris and is not uncommon. On examining my specimens of *T. obscuros athos*, two from Kallar certainly answer superficially to *T. distans*. Emmet has specimens from the Nilgiris and the Palnis and he informs me that he has examined the clasps of the latter and they answer to the description of the clasps of *T. distans* given by Ormiston in his 'Butterflies of Ceylon'.

302. *Halpe moorei moorei*: Sigur Ghat in December (Emmet).

Local *Padraonae*:—

279. *Padraona cato cato.*
280. *Padraona pseudomaesa pseudomaesa.*
303. *Padraona tropica diana.*
304. *Padraona palnia palnia.*

Cato is abundant on the Nadgani Ghat in October. Also recorded from Singara in December and the Mettupalaiyam Ghat in February.

Pseudomaesa from Singara in December, *tropica* from the

Nadgani Ghat in October and from the plateau. *Palnia* from the plateau.

Additional information on recorded species:—

11. *Papilio buddha*: Mid-Nadgani Ghat in September.

74. *Mycalesis visala visala*: Common at Guddalur in the autumn.

101. *Euripus consimilis meridionalis*: Two females from Kallar. (Sanders).

108. *Limenitis procris undifragus*: Nadgani Ghat in September and July. Silent Valley in May. By the Moyar River in December. (Pringle).

160. *Megisba malaya thwaitesi*: Kallar, 24th July 1945.

183. *Nacaduba helicon viola*: Nadgani Ghat in September.

(188. *Nacaduba noreia hampsoni*: Major Maitland Emmet caught a good series of these at the foot of the Coolie Ghat in the Palnis in May of this year. This is, of course, outside the Nilgiris, but an interesting record).

193. *Iraota timoleon arsaces*: Kallar, July or August. (Sanders). Foot of Nadgani Ghat, May. (Pringle).

194. *Horsfieldia anita dina*: Near Coimbatore. (Pringle). Gudalur in December. (Emmet).

196. *Amblypodia centaurus pirama*: Kallar, July or August. (Sanders).

200. *Surendra todara todara*: Below Coonoor. (De Nicéville). Nadgani Ghat in July or August. (Sanders).

204. *Spindasis abnormis*: Several records from Coonoor. (Florence).

209. *Pratapa cleobis*: Gudalur Dak Bungalow, below Coonoor, and from Wellington, in July and August. (Sanders).

211. *Tajuria cippus cippus*: Can be obtained on Loranthus below Wenlock Bridge and at Kallar in July and August. (Sanders).

213. *Cheritra fraja jaffra*: Nadgani Ghat in September.

215. *Horaga onyx cingalensis*: Can be caught near Sultan's Battery in January. Local.

217. *Catapoecilma elegans myositina*: St. Catherine's Falls, Kottagiri, in December. (Emmet).

219. *Zeltus etolus*: Nadgani Ghat in September.

227. *Bindahara phocides moorei*: ♂♀ Kallar in May. (Emmet).

253. *Baracus vittatus subditus*: Dimbum Ghat in July. (Pringle).

Errata:—

203. *Spindasis schistacea*. 251. *Astichopterus jama mercara*. There are no records of these species: remarks apply to *S. vulcanus* and to S. *pulligo* respectively.

262. *Notocrypta paralysos alysia*: Hampson's is the only record I can find. My remarks apply to *N. curvifasciata*.

KETTI. M. A. WYNTER-BLYTH, M.A. (*Cantab.*)

July 1945.

18.—TWO BURMESE SPIDERS WHICH MIMIC SCORPIONS.

(*With 2 plates*).

The area of country close to Tongup, Burma is very rich in spiders. During a period of three weeks in that area I collected over seventy different species including the following two scorpion mimics.

These are apparently allied to the Genus *Araneus*, but as I have as yet been unable to identify them the following is an ecological description only. In these numbers the tip of the abdomen is elongated to form a scorpion-like 'sting'. The first two pairs of legs are larger than the hind two pairs, the femur being relatively large. Just as the mimicry of the ant-mimic genera *Myrmarachne* and *Amyclaea* is partially dependent upon the antennae-like waving of the first pair of legs, and by the ant-like movement of the spider, so scorpion-mimicry of these two species is dependent upon the aggressive attitude adopted by the spider when it falls to the ground on being disturbed in its web. Most members of the genus *Araneus* 'sham death' when they fall to the ground, but these two species curl the tip of the abdomen forward over the cephalothorax and hold the first two legs on each side close together, and straight forward, appearing very like the pincers of a scorpion.

Both these spiders spin simple orb webs about eight inches in diameter, which are found under shrubs and trees in a vertical position.

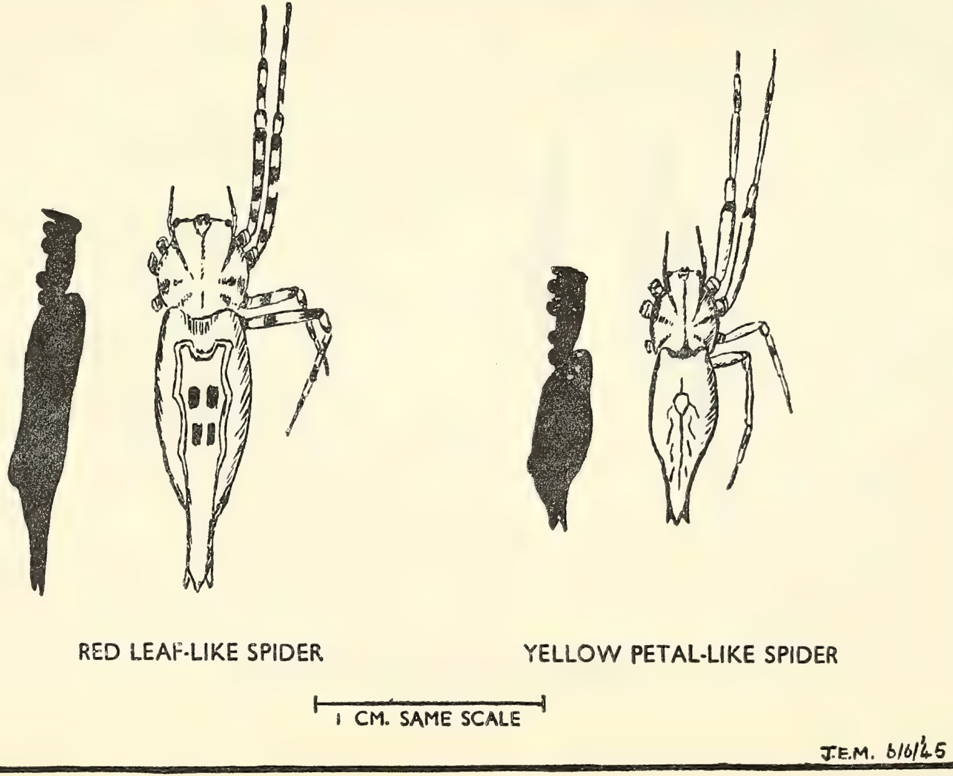
The web of the yellow species is found amongst small shrubs with a yellow flower. When I saw this spider I thought that it was a dried petal hanging in a web. The spider rests just above the centre of its web with its abdomen flat against the webbing, quite un-scorpion like in this position. Dried cast skins and petals are also found in the web providing what Hingston terms 'Decoy Devise' protection. When the web is touched the spider drops to the ground and adopts the scorpion mimic attitude described above. This will give protection due to the apparent rapid change in form just as a rapid change in colour gives 'Flash colouration' protection.

The red species is found beneath trees with very finely divided compound leaves, the dried leaflets of which are reddish brown in colour. These dried leaflets are found in the web as 'decoys'. The spider rests in the centre of the web, the flattened tail being apparently the stem of a leaflet. When the web is touched the spider drops as the yellow species does.

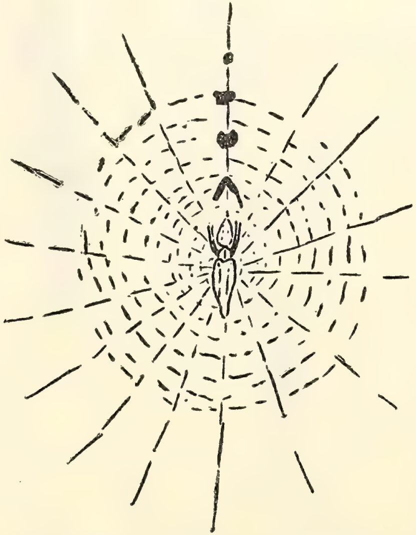
In this area I found many species of *Araneus*, very dried-leaf like in form when they are seen hanging in the web, or more usually resting at the side, but the above two are the only mimetic forms which I have found in Burma.

The mimetic protection obtained by these spiders is due entirely to their scorpion-like form and attitude when on the ground. They do not receive protection because they are found

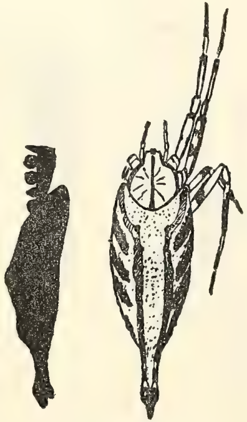
SPIDER-SCORPION MIMICS


RED LEAF-LIKE SPIDER
YELLOW PETAL-LIKE SPIDER
1 CM. SAME SCALE
J.E.M. 6/6/45

SPIDER-SCORPION MIMIC



WEB WITH COCOON AND DEBRIS



HOUSE SPECIES

ONE CM. SAME SCALE

JEM, 5/10/45

in areas where scorpions are plentiful because I found very few small scorpions in this area.

I would like to amplify this statement with reference to the ant-mimic genus *Myrmarachne*. Around Tongup, the red ant *Oecophylla smaragdina* is very common on the mango trees. The ant-mimic spider *Heplataloedes* is also common on those ant infested trees and is never found on trees without ant colonies. In this case the mimetic protection is two fold, firstly that of similarity and secondly that of living with the ant 'model'. Many other species of *Myrmarachinae,* usually shiny black species, are common in Tongu but I have never found them on trees where a model ant colony exists. There may be a similar ant to be found, but in the field they cannot be 'paired' together ecologically. In these cases as with the scorpion-mimics described above the protection obtained is only half that of the red ant-mimic.

C/O Head Quarters,
22nd (E.A) Infantry Brigade, J. E. MARSON,
S.E.A.C. F.R.E.S.
8th Spetember 1945.

P. S.—I have today found another species of scorpion-mimic spider which is to be found in dwellings here in Mawchii. Its web is spun so that it is visible against the sky and a typical position is from the eaves to the supports of a verandah.

The web is usually about eight inches in diameter with about twenty widely spaced radiatory web strands. The spider rests centrally with its abdomen pointing downwards, the first two pair of legs being straight forward and the abdomen tip flattened against the web. The cocoon is spun just above the centre of the web in a position between the spider's first two pairs of legs. A vertical line of widely spaced debris, acting as 'decoy' device continues upwards from the cocoon. The illustrated web (vide fig.) contains in insect's leg and three sets of insect remains.

The spider's abdomen is centrally white with small pink dots and the markings are golden brown standing darker to the sides of the abdomen.

When in the web the spider is difficult to see but when disturbed it moves in the web with the tip of the abdomen curled forward, a position which it continues to adopt when it falls to the ground on a thread.

Mawchii, J. E. MARSON,
5th October 1945. F.R.E.S.

Vott, H. B. Adaptive Colouration in Animals (1940).
Hinston. I.M.S. Field Observations on Spider Mimics. P.Z.S. 1927 Vol. IV.
,, ,, Devices in Spider Webs. P.Z.S. 1927 Vol. XVIII.

19.—*CURCUMA PSEUDOMONTANA* GRAH.

Curcuma is one of the first plants to show up in Khandala shortly after the beginning of the rainy season, and from its first appearance till well into October it is one of the most showy and abundant plants in the district. For this reason the very deficient and often contradictory descriptions found in current floras are almost inexplicable. I have been observing this plant for the last four years, and it was only after many a day spent in pouring rain that the various difficulties concerning the Khandala Curcumas were solved. Through all these years I have often had the company of Mr. C. McCann, who at a moment's notice has always been ready to brave the wettest and muddiest of conditions in Khandala and elsewhere; without his support and company these notes could not have been written.

Cooke (II, 734) when speaking of *Zigiber cernuum* Dalz. makes an interesting remark, which can be fully applied to the various species of wild Curcumas: 'The plant unfortunately flowers in July, at which time the whole of the hill-sides are streaming with water, rendering plant-collecting a task of no ordinary difficulty.' The reason for this 'unfortunate' difficulty will be appreciated when it is known that the rainfall in Khandala for the last 15 years has averaged 188.37", with a maximum of 230.90" in 1942 and a minimum of 154.85" in 1932; most of this rain comes between June 15th and August 31st; this is the reason why plant collecting during that most interesting part of the monsoon is a task of no ordinary difficulty. Due to such abundant rain, rocks become covered with slime and soil turns loose and slippery, so that the danger of landing at the bottom of one of the ravines after a very swift journey is a very real danger and is always present during the monsoon.

As a consequence of such difficulties, the material preserved at Kew and other national or foreign herbaria is very scrappy; hence it is that descriptions of the plant such as are found in Cooke's *Flora* or in Schumane's *Zingiberaceae*, etc., are necessarily very incomplete, since they are mainly, if not exclusively, based on preserved herbarium materials. In the following pages I shall try and give as complete a description of the Khandala *Curcuma* as I have been able to gather in four years of intensive study of hundreds of living specimens.

Occurrence. *Curcuma pseudomontana* Grah. is one of the commonest plants in Khandala throughout the rainy season; it is particularly abundant about St. Xavier's Villa, on the plateau near Kune Katkari Settlement, on Behram's Plateau and on the top and upper slopes of Bhoma Hill (popularly known as 'The Sausages'); it is rarely to be found in the ravines, except on the upper slopes where the climatic conditions are about the same as those prevailing in Khandala Plateau.

From all these places large numbers of specimens have been collected; often after a day of Curcuma-hunting there were as many as fifty different specimens on the tables of our improvised laboratory. Each plant was examined and measured carefully for its height, size of leaves, colour of bracts, etc. After this thorough study of the plant in the living condition, it was conveniently dissected, poisoned and pressed; most of the specimens collected at Khandala are now preserved in the Blatter Herbarium, St. Xavier's College, Bombay

From the very beginning there were a number of details that seemed to differ considerably from the description given in Cooke's *Flora*. In order to get an insight into the story of the development of *Curcuma pseudomontana*, a square plot of about 20 m. side was marked off with stones in front of and near St. Xavier's Villa. Visits to Khandala and to this 'observation plot' were paid every two or three weeks from June to October; this went on for three years. On the fourth year the plot was found to be too large, and certain anomalies that appeared in some of the plants could not be accounted for. In 1944 a much smaller plot was selected, about 2 sq. m. containing about 5 or 6 *Curcuma* plants. The results obtained from visiting such plots and other places in Khandala amply repaid the trouble taken during four successive years.

DESCRIPTION OF *Curcuma pseudomontana* Grah.

Rhizome conical or cylindrical, about 6.5 × 2 - 2.5 cms. Fibrous roots many, stout (about 5 mm. diam.), up to 20 cms. long but generally shorter (8 - 15 cms.); each root bearing at its end an elliptic or globose tuber of 1.5 - 4 × 1.5 - 2.5 cms. Both the rhizome and the small tubers are white inside in their young stage, or white with a pale tinge of yellow; as they become old, and their starchy contents get absorbed, the colour of the tubers deepens into orange yellow. Rhizome and tubers, when freshly cut, are pleasantly aromatic and taste very strongly of Ginger. The small tubers are formed towards the end of the rainy season and together with the rhizome are the means of insuring the survival of the plant during the dry periods of the year; at the beginning of the next monsoon the plant draws on last year's supplies for its immediate growth and flowering. During August one can see the remains of the old, exhausted tubers at the end of decaying roots, and the beginnings of the new tubers on freshly formed roots.

Generally there is but one aerial shoot from each rhizome; on several occasions, however, we have found two shoots growing side by side from the same underground rhizome.

The leaves come out either *after* the inflorescence spike, or occasionally at the same time as the spike or in very rare cases just before the spike. Generally when the spike is about 10 - 15 cms. high, the first leaf appears above ground, all curled up longitudinally; the unfolding of the leaf is just a matter of a few hours; as the season progresses other leaves appear, so that by the end of the rains there are 5 - 7 leaves per plant.

The size of the leaves varies with the season and the location in which the plant is growing; on exposed slopes near the top of

Bhoma Hill throughout the whole season, or elsewhere at the beginning of the rains, leaves are relatively small; during September and early part of October they attain such large proportions that at a little distance such plants are easily mistaken for wild banana plants. There is in Blatter Herbarium a set of specimens with leaf blade 69 × 30.5 cms., petiole from ground level to leaf base 74 cms. long; the largest leaf collected up to the end of 1944 was 160 cms. long from ground level to tip of leaf.

Leaves are entire, ovate, or oblong lanceolate, acute or shortly acuminate, base acute or shortly decurrent into the petiole; lateral nerves numerous, parallel among themselves and forming a broad angle with the midrib, very conspicuous on both sides of the leaf, which occasionally even appears plaited. Petiole stout, cannelled above; base of the petiole broadening out and forming a sheath which embraces the stem tightly; at the upper part of the sheath there is a conspicuous ligule, which is truncate, membranous, up to 16 mm. broad, 5 mm. long, entire, ciliate at the edges. The general colour of the leaf and petiole is of a deep rich green, and of about the same intensity on both sides, becoming a little paler or almost white at the base of the petiole.

Inflorescence spikes come out together with or before the leaves; when these appear, they push the spike to one side, so that inflorescence is definitely lateral. By the middle of August lateral spikes decay and for a time flowers are not to be seen. In the second half of the monsoon all the plants have spikes coming out of the centre of the leaves i.e. spikes are central; for three years this proved an insoluble riddle. All the plants within the observation plot were with lateral spikes up to August; then suddenly and unaccountably such plants seemed to disappear and a new set of plants with central spikes take their place. For all this unfortunate riddle we have Cooke and his key to thank. The solution of the puzzle was only found when eventually a plant was noticed with a large central spike and the remains of a decaying lateral spike still attached to the same plant. This at once suggested that *one and the same plant* had lateral and central spikes at different periods. After this, plants were collected wherever they showed a lateral spike: on dissecting such plants, invariably we found that there was a central spike still enveloped by the leaf sheaths but with the upper coma bracts already coloured rose or purple. On July 21st, 1945, a number of plants were examined for the double spike; the lateral spike was fresh, in full bloom; at first the central spike seemed to be absent altogether, but after careful dissection a minute central spike was found in most plants, the 'embryonic' spike being only about 1.5 cms. long and about 3 to 5 mm. at its broadest, and completely colourless. From observation of the living plant we may, therefore, say that *Curcuma pseudomontana* Grah. *has a lateral spike at the beginning of the flowering season* ('flowering spike vernal or aestival, lateral' Cooke) *and a central one at the end of* *the rains* ('flowering spike autumnal, rising in the centre of a previously formed tuft of leaves', Cooke). It is obvious, therefore, that such keys as are to be found in Cooke, Schumann, Baker, etc. where the basis for the classification of the various specimens of *Curcuma* is the position (lateral or central) of the spike, must be scrapped altogether.

The size of the spike varies considerably with the season; the biggest spikes generally occurring during the second part of the monsoon, i.e. during September and early October. In June the spikes are small, from 6 to 12 cms. long and 2 to 3 cms. in diameter, with a peduncle 6 to 10 cms. long. At the end of September some of the spikes measured in Khandala were 25 × 13.5 cms. with a peduncle 40 cms. long.

Floral bracts green, or green with purplish or reddish tips, rounded, saccate, a little shorter than the bracts of the coma. Each flowering bract subtends sometimes three, most often four, and occasionally five flower buds which open out successively.

'Sterile' bracts of the coma are very variable in colour; the following are some of the colour variations noticed in Khandala: (i) Uniform pink of various shades; this is the commonest colour. (ii) Pure white all through. (iii) Pure white with pink tips. (iv) White with pink tips and a broad stripe or stripes of pink colour running down along the centre of the bract. (v) White with several green stripes running longitudinally downwards and parallel to each other. (vi) Pink with very deep purple, almost black, tips. The size of the coma bracts is up to 9 to 10 × 4.5 cms. Generally the brightly coloured coma bracts are sterile; but towards the end of the season they often support a number of buds or flowers, especially bracts away from the very apex of the spike. Both coma and floral bracts are free in the upper part, but are attached to the spike by their bases and lower portions of the sides, thus forming a sac-like cavity for the flowers. The venation of all bracts is very prominent, parallel, and in the case of the lower bracts often marked with greenish or purplish lines.

Calyx membranous, about 10 mm. long, or occasionally going up to 18 mm. in length; 3-lobed, the lobes 4 to 6 mm. long and about as broad, rounded or subacute at the apex; occasionally the calyx splits longitudinally down one side. The colour of the calyx is pale creamy yellow almost white.

Corolla at first pale cream in colour with a touch of pink at the tips of the petals, later on turning completely yellow; up to 6.4 cms. long; corolla tube up to 3 cms. long, 3 to 4 mm. broad at the height of the calyx mouth; corolla limb 1.5 cms. in diameter. Petals subequal, or the dorsal petal larger than the other two, ovate, acute or mucronate; lateral petals ovate, obtuse, with hyaline margins.

Stamen one, 5 to 7 mm. long including the spur at the base, two celled, each cell ending in a spur slightly curving outwards; anther connate with the staminodes, filament short, almost O; the whole stamen white. Staminodes two, petaloid, ovate-oblong, slightly oblique at the apex, obtuse almost truncate, free limb

12 × 9 mm. Dehiscence of the anther cells seems to be through a small pore in each cell near the base.

Lip divided to half its length or merely notched, with two lines of reticulately spongy tissue running down the whole length of the lip along the centre; lip 12 × 12 mm. Lip and staminodes bright yellow, uniform in colour with the petals.

Style filiform, up to 38 mm. long, pale white in colour; stigma small, variously lobed; nectaries two near the base of the style, 5 mm. long, 1 mm. broad and about 0.5 mm. thick, rounded at the tip, whitish in colour. Ovary 3-locular, inferior, densely hirsute outside, the hairs being short, whitish and pointing upwards; the whole ovary greyish in colour. Fruit 3-locular, trigonous, 1.3 × 1 cm., white in colour at maturity; seeds numerous, arillate with a hyaline aril. Given the large number of flowers produced by the plant, it is remarkable that the number of fruits is not correspondingly large. This may be due to the fact that in many flowers fertilisation does not take place at all, or if it does, insects get at the fruit too soon and destroy it in the early stages; towards the end of the rainy season it is rare to find a fruit which has not been more or less damaged by insects.

A FEW NOTES ON THE NOMENCLATURE OF THE KHANDALA CURCUMA.

Graham called his plant *C. pseudomontana*, and the description, however imperfect it may be in many respects, seems to apply to the Khandala *Curcuma*. Baker in Hooker's Fl. Br. I. (6: 214, Dec. 1890), and Schumann in Engler's Pflanzenreich (iv, 46, p. 106, Nov. 1903) reduce Graham's *C. pseudomontana* to *C. montana* Roxb.; Index Kewensis (i: 672, 1895) gives *C. pseudomontana* Grah. as 'nomen rejiciendum', and mentions *C. montana* Roxb. as the only correct name. Cooke (II, 731) makes a few apposite remarks on the subject that deserve consideration. The question of the colour of the tubers must be left aside altogether, as it varies not with the species but with the age of the plant. Roxburgh says of *C. montana*: 'bulb conic, with pale yellow, palmate tubers'; Schumann adds that the tubers are sessile with fleshy roots. Graham clearly states (Cat. no. 1477) that in his plants the bulb or root is oblong, and that 'from it descend rather stout fibres bearing at their ends round tubers of the size of a small potato'. We have examined hundreds of specimens in Khandala at various times, and in every single case the tubers were found to be oblong or globose, but never palmate, and always at the end of long fleshy roots, never sessile.

The question as to whether the spike is vernal or autumnal, lateral or central, seems also to have vexed many of the authors who have written on the *Scitaminaceae*; but the cause of such a confusion must be attributed to defective observation of the plant, which has the 'unfortunate' habit of bursting into flower during the most unpleasant part of the year.

Whilst reading carefully through the description of *Curcuma Ranadei* Prain in *J.B.N.H.S.* (ii: 463, 1898) one cannot fail to notice the very close similarities between Prain's new species and Graham's *Curcuma pseudomontana*. For three years I have examined specimens of Curcuma growing on the upper slopes of Bhoma Hill, where due to the exposed position of the plants, they go through the monsoon as dwarfed specimens; when these dwarf plants are compared with *Curcuma Ranadei* Pr., it is impossible to see any difference between them; and the Bhoma Hill specimens are decidedly *Curcuma pseudomontana* Grah.

NEW KEY TO THE CURCUMAS OF BOMBAY PRESIDENCY.

In order to facilitate the identification of Bombay Curcumas, the following key is proposed, where the whole question of lateral and central spikes has been left aside as unsatisfactory; this key is purely artificial, and is intended for the convenience of field workers who may in the past have experienced some difficulty in identifying their Curcumas from the key supplied by Cooke. The basis of the present key is the colour of the flowers, which seems to be permanent for a given species of *Curcuma;* the only claim we make for the present key is that it has been used for the last two years and has been found to be helpful and correct.

In the present key we have included two new species of *Curcuma* described by Blatter in 1930, *Curcuma inodora* and *Curcuma purpurea.* I have omitted *C. Ranadei* Pr. as being synonymous with Graham's *C. pseudomontana.*

Corolla yellow :

Rhizome small :

No tubers at the end of the root fibres : ... ... *C. neilgherrensis.*
Small subglobose tubers at the end of the root fibres ... *C. pseudomontana.*
Rhizome large; tubers sessile ... ... *C. amada.*
Corolla white or yellowish white ... ... *C. amada.*

Corolla purple :

Corolla with a yellow streak on the lip :

Tubers numerous :

Tubers at the end of the root fibres ... ... *C. inodora.*
Tubers sessile, palmately divided ... ... C. *aromatica.*
Tuber one, sessile ... ... *C. purpurea.*
Corolla without a yellow streak on the lip ... ... *C. decipiens.*

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